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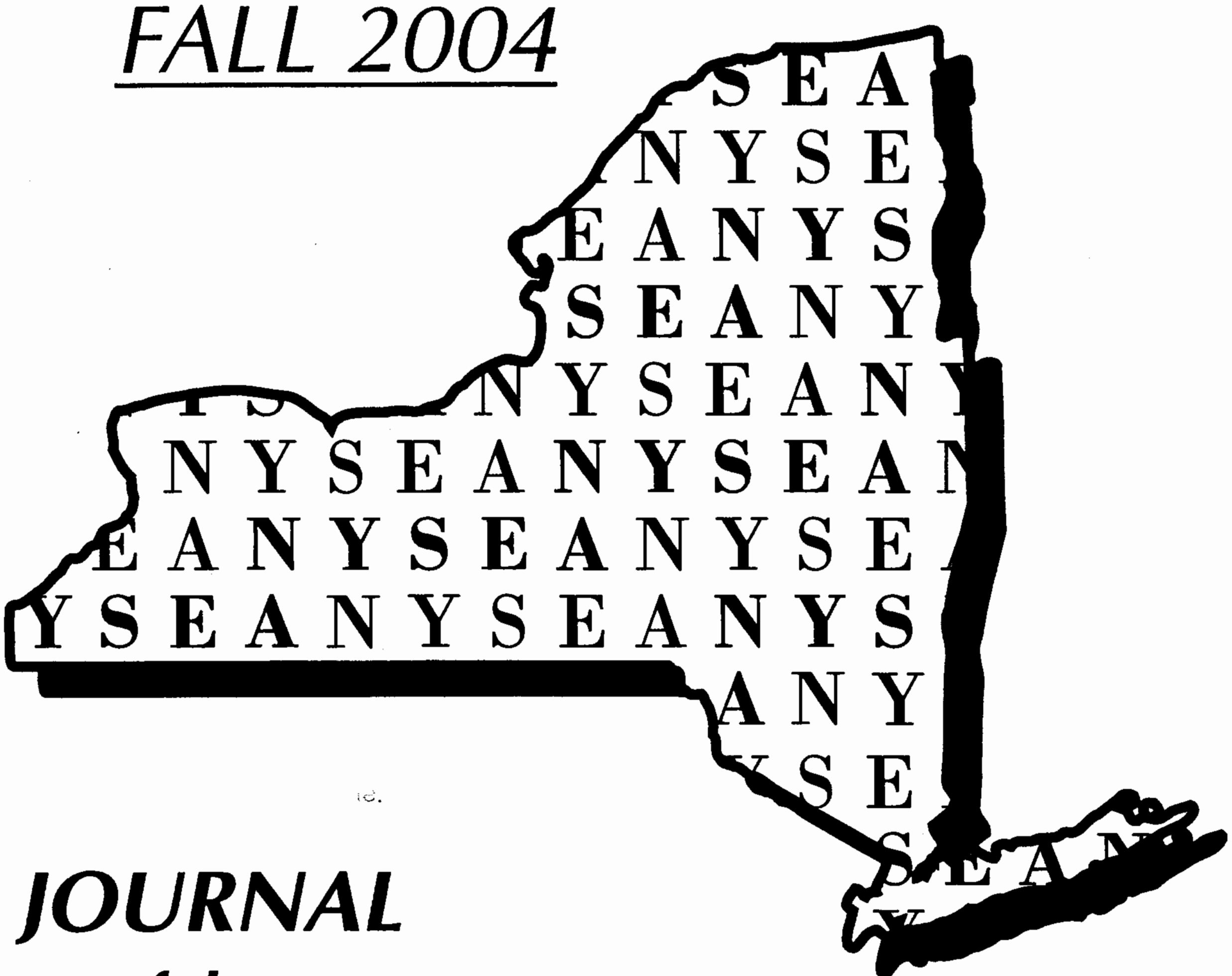

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CONTENTS

ARTICLES

EDITORIAL

The *New York Economic Review* is an annual journal, published in the Fall. The *Review* publishes theoretical and empirical articles, and also interpretive reviews of the literature. We also encourage short articles. The *Review's* policy is to have less than a three month turnaround time for reviewing articles for publication.

MANUSCRIPT GUIDELINES

1. Please submit three copies of a manuscript.

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4. Footnotes should appear at the end of the article under the heading of "Endnotes."

5. Citations in the text should include the author and year of publication, as found in the references, in brackets. For instance (Marshall, 1980).

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THE YANKEES EFFECT: THE IMPACT OF INTERLEAGUE PLAY AND THE UNBALANCED SCHEDULE ON MAJOR LEAGUE BASEBALL ATTENDANCE

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ABSTRACT

Major League Baseball introduced interleague play in 1997 and an unbalanced schedule between division and non-division opponents in 2001. These changes were designed to lower costs to organizations within the league and boost attendance. A game-to-game attendance model is specified for the Major League Baseball teams for 2001. We find that interleague play significantly increases attendance in National League cities only, while the unbalanced schedule has positive but insignificant attendance effects in American League cities. Working from these results, the model was re-specified to include the dominant team of this era, the New York Yankees, as a separate determinant for both interleague and divisional games. It was found that the Yankees have a large and significant effect on interleague attendance, while the impact of the other teams is not found to be significant. The same impact, to a lesser extent, is found for the divisional opponents of the Yankees under the unbalanced schedule.

Major League Baseball has made two major scheduling innovations in recent years. In 1997, interleague play was introduced with National League (NL) teams playing American League (AL) teams for the first time in the regular season. In 2001, an unbalanced schedule was introduced in each league. The number of games against divisional opponents was increased, while games against non-divisional foes were reduced. Both changes were aimed at improving the profitability of major league clubs by simultaneously reducing travel costs and increasing revenues by filling more seats at the stadiums.

Interleague play was intended to lower travel costs and increase attendance. While there is little doubt that a series between the New York Mets and the New York Yankees or the Chicago Cubs and the Chicago White Sox would be very popular, others questioned the interleague concept for teams without natural interleague geographic rivals. Bud Selig, the commissioner of Major League baseball, believes

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that interleague play has boosted attendance; he has been quoted as saying "…the attendance figures show it (interleague play) has been a success."

The savings in travel costs are assumed to be positive and are not the object of this study. The aim of this paper is to see if interleague play and the unbalanced schedule have had any impact on individual team attendance in the 2001 season. A regression model, with game-by-game individual team attendance as the dependent variable is specified and tested. Common independent variables in the baseball literature are included in the model in addition to variables for divisional games and interleague games.

For all of major league baseball, interleague games appear to increase attendance slightly, but these increases are not statistically significant. In examining each league individually, interleague games lead to a decrease in attendance, although not significant, in the American League, but a highly significant increase in the National League. Examining the National League more closely, it appears that most of the increase in attendance comes from the teams that played the New York Yankees, the premier team in baseball at this time, during interleague play. Separating the interleague variable into interleague Yankee games and interleague non-Yankee games led to a positive and highly significant increase in attendance for the Yankees variable, but a much smaller, and insignificant, increase for non-Yankee interleague games.

For the unbalanced schedule, the result is similar. For the league as a whole, divisional opponents appear to attract slightly more fans, although the effect is not significant. Examining each league separately, however, reveals that the effect is positive for the American League, the league with the Yankees, and negative for the National League. Separating the divisional opponent variable into Yankees and non-Yankees for the AL reveals that the Yankee games had a positive and significant effect on attendance, while other divisional rival games led to a negative, although insignificant, impact on attendance.

The paper is organized as follows. Section II presents a model of game-by-game baseball attendance and shows empirical results for the model, including interleague and division rival games, for major league baseball as a whole, the American League, and the National League. Section III examines the effect of playing the Yankees individually for the National League in interleague play and for the American League in divisional play. Section IV discusses the findings and concludes the paper.

II. MODEL OF GAME-BY-GAME BASEBALL ATTENDANCE

Studying the factors that determine Major League Baseball attendance has been a popular activity for economists because the market is large and statistical data are readily available. Independent variables included in existing models of baseball attendance include population, income per capita, star players, and recent success (Noll, 1974), televised games, quality of the team, and availability of substitutes (Demmert, 1973), expected probabilities of winning a championship (Whitney, 1988), salary structure (Richards and Guell, 1998), turnover in team rosters (Kahane and Shmanske, 1997), and earlier impacts of interleague play (Butler, 2002).

All of the models of Major League Baseball attendance are slightly different, but for the purpose of studying the effect of interleague and divisional games, the dependent variable in this study is the attendance of each game. The independent variables are intended to specifically account for game-to-game differences that can occur in attendance over the course of a season. The attendance model is as follows.

$$\begin{aligned} Attn_t = {} & \alpha_1 + (\alpha_2\, Opday_t + \alpha_3\, April_t + \alpha_4\, May_t + \alpha_5\, June_t + \alpha_6\, Aug_t + \\ & \alpha_7\, Sept_t + \alpha_8\, Oct_t) + (\alpha_9\, Mon_t + \alpha_{10}\, Tue_t + \alpha_{11}\, Thu_t + \alpha_{12}\, Fri_t + \\ & \alpha_{13}\, Sat_t + \alpha_{14}\, Sun_t) + (\alpha_{15}\, Rfpg_{t-1} + \alpha_{16}\, Rapg_{t-1}) + (\alpha_{17}\, Inc_t + \\ & \alpha_{18}\, Pop_t + \alpha_{19}\, Foot_t + \alpha_{20}\, Bask_t + \alpha_{21}\, Hock_t + \alpha_{22}\, AL_t + \\ & \alpha_{23}\, Newstad_t + \alpha_{24}\, Payroll + \alpha_{25}\, Price) + (\alpha_{24}\, Vrfpg_{t-1} + \\ & \alpha_{25}\, Vrapg_{t-1} + \alpha_{26}\, Div_t + \alpha_{27}\, Intleague_t) + \varepsilon_t. \end{aligned} \quad (1)$$

The variables are listed below. All data comes from espn.com, except for population and income per capita, which comes from the U.S. Statistical Abstract and Statistics Canada, payroll, which comes from Slam Sports on canoe.ca, and average ticket price, which is from www.teammarketing.com.

The dependent variable, Attendance (ATTN), is per-game attendance for each home game of the season for each team. The attendance figures given in this paper are the paid attendance figures presented by Major League Baseball. These figures do not present the fans that actually walk through the gate and enter the stadium. Therefore, season-ticket figures may be important to distinguish between these two groups. Teams who sell a large number of season tickets and perform poorly during the season may have a considerable drop-off in actual number of fans in the seats later in the season, which the dependent variable in this model may not capture. We do not have these figures, but a future study using that data would serve as an interesting comparison.

The independent variables start with an intercept. The remaining independent variables are grouped into categories based on the factors underlying their impact on attendance. The first category of independent variables is dummies for the months of the year, with July the excluded dummy. The first variable included is for opening day (OPDAY). Baseball teams often have festivities or promotions such as fireworks associated with opening day at their ballpark and traditionally are very good draws, regardless of opponent. A separate dummy variable is included to account for this effect.

Baseball attendance is likely determined by the weather and by the pennant race. Early in the season (April and May) the weather is likely to be cold, especially in northern cities, and the divisional races are not yet important in the minds of the average fans. Weather improves during the summer months. In the fall the playoff races intensify, but the weather may again be troublesome. For 2001, the months of September and October will likely show the effects of the events of September 11th. Therefore, it is expected that the summer months will have the largest coefficients and the early month and late months will probably have the lowest attendance.

The second category includes the days of the week dummies, with Wednesday excluded. Attendance will depend upon the opportunity cost of fans' time, which will likely be greater during the week due to work and family commitments. Therefore, the weekend days are expected to have the largest coefficients.

The third category is on-field characteristics of the home team. The variables include average runs scored by the home team going into the game (RFPG) and the average runs given up by the home team going into the game (RAPG). These variables represent runs scored per game that the fans would expect to see, but also serve as a proxy for the home team winning. Due to possible multicollinearity, winning percentage and runs-for per game and runs-against per game were not simultaneously introduced into the model. Most of the variation in win percentage can be explained by how many runs a team scores and gives up on the average. Therefore, runs-for per game and runs-against per game were included in the model and win percentage was not[1]. In addition, team payroll, which we will explain later, also serves as a proxy for win percentage. RFPG is expected to be positive and significant and RAPG is expected to be negative and significant.

The fourth category includes characteristics of the home city. Income per capita (INC), the population of the metro area (POP), the existence of other sports teams (FOOT for football, BASK for Basketball, and HOCK for hockey), which league the team is in (AL dummy for AL teams), if the team is in a new stadium for this year (Pittsburgh and Milwaukee for 2001), team payroll for the season (PAYROLL), and average ticket price for a game (PRICE) are all included in this category. The income per capita variable has had contradictory results in the literature, but recent studies have shown baseball games to be a normal good (Kahane and Shmanske, 1997). A larger population would mean more fans, which should lead to a positive coefficient. Other sports teams in the city are included to determine if these sports are substitutes or complements to baseball. If there is a difference in league attendance, a dummy variable for AL teams is included. New stadiums can generate interest that is independent of the other factors mentioned. People may attend the game to experience the new stadium. If a new stadium creates this kind of interest, the sign on this dummy variable should be positive.

Team payroll is included in the regression to determine if fans are swayed by ownership spending beyond the impact that payroll has on winning and scoring. Payroll has been shown to influence the win percentage of a team (Zimbalist, 2003). Causality between payroll and win percentage has been shown to run in both directions (Zimbalist, 2003). Payroll also serves as a proxy for "star players" as the higher salary teams have more superstars, but it could also serve as a proxy for high-priced mistakes by teams. Average ticket price is included in the model to examine differences in prices across teams. Although it is assumed that tickets are priced in order to maximize total revenues, prices are set prior to the start of the season. Since ticket prices are based on expectations of team performance, rather than actual performance, a deviation from expected performance may result in suboptimal (ex-post) prices[2].

Visiting team characteristics are the main focus of this paper, with the impact of divisional rivalries and interleague play being the main concerns. Before addressing these issues, the same team attributes are included for the visiting team as for the home team. Visiting team runs for per game (VRFPG) and visiting runs against per game (VRAPG) are included as an average values going into the game. As with the home team, these variables serve as a proxy for the quality of the opponent and for number of runs scored the fans can expect to see.

Interleague play was introduced in 1997 to increase revenues and lower costs. Teams in the same geographic areas belonging to different leagues would now play each other. The innovation was judged as a success by the offices of Major League Baseball (Neft, Cohen, and Neft, 2000) and continues today. If interleague play still generates fan interest, the sign on the coefficient should be positive.

In 2001, baseball moved to an unbalanced schedule where teams would play division rivals more often. Games against division rivals rose to nine or ten home games a year. Games against non-divisional opponents were reduced. If playing divisional rivals increases fan interest, the sign on the dummy variable for divisional opponents should be positive.

Table I presents regression results for the entire major league baseball sample and for each league individually. The regression is run using White's heteroskedasticity-consistent standard errors and covariance.

Dummies for the days of the week and months of the year yielded the expected results. Weekends are more popular days at the stadium, with Saturday having the largest attendance and Friday having the second largest, all other factors being equal. The summer months have the highest levels of attendance. There was a large decline in Major League Baseball attendance in September and October, likely resulting from the events occurring on September 11th, which may have nullified any positive influences pennant races may have had on attendance in 2001.

Fans appear to respond to home teams that score runs and win games. Runs for per game, which includes the direct impact of the scoring of the home team and serves as a proxy for winning, was found to be positive and significant at the one percent level in both leagues and for baseball as a whole. Runs against per game was found to be negative in all specifications and significant for Major League Baseball as a whole and in the American League. Giving up more runs per game leads to a higher likelihood of losing and therefore lowers attendance.

The effects of income per capita and population are significant across regressions as baseball appears to be a normal good to fans, but population has a very small negative effect on attendance. It could be that larger cities have more substitutable leisure activities that lead to slightly lower attendance. Dummies for the American League (AL) in the Major League Baseball regression and a new stadium (NEWSTAD) in the MLB and NL (as Pittsburgh and Milwaukee, both NL teams, had new stadiums in 2001) regressions were found to be significant. The AL attendance was lower than the NL, which is the opposite result found in Kahane and Shmanske (1997), where the NL had lower attendance. New teams, such as Colorado, and new stadiums, such as San Francisco and Atlanta, may account for this

Table I:
Baseball Attendance Regression for all of Major League Baseball, National League, and American League

	MLB	AL	NL
Variable	Coefficient (T-stat)	Coefficient (T-stat)	Coefficient (T-stat)
Constant	-6715.981*** (-3.1977)	7329.656** (1.9952)	-21358.07*** (-7.4131)
OPDAY	30703.36*** (10.8882)	18119.22*** (6.1800)	31916.75*** (8.8355)
APRIL	-5970.974*** (-10.7189)	-6641.414*** (-8.2451)	-5548.732*** (-7.8536)
MAY	-4307.018*** (-8.3174)	-4644.354*** (-5.7550)	-3995.180*** (-6.6853)
JUNE	-1332.319*** (-2.6585)	-2147.514*** (-2.9333)	-526.4122 (-0.8701)
AUG	-1844.495*** (-3.5290)	-1685.235** (-2.1297)	-1939.367*** (-3.0629)
SEPT	-4057.489*** (-7.2385)	-5175.143*** (-6.1264)	-2615.298*** (-3.7978)
OCT	-6325.073*** (-5.4816)	-7380.613*** (-5.2347)	-6154.061*** (-3.5352)
MON	568.3748 (0.8640)	1039.462 (1.0719)	-235.5083 (-0.2789)
TUE	-704.3083 (-1.4465)	-1100.966 (-1.5957)	-340.6931 (-0.5308)
THUR	493.8769 (0.9904)	645.7989 (0.89030)	209.8090 (0.3280)
FRI	4665.089*** (8.9811)	5228.609*** (6.8978)	4051.347*** (6.2069)
SAT	8272.874*** (15.9773)	8099.887*** (11.0111)	8352.827*** (12.3186)
SUN	5306.086*** (10.2508)	5261.770*** (6.8351)	5193.414*** (7.9009)
RFPG	2359.266*** (9.1055)	1315.158*** (3.8397)	4071.193*** (8.3687)
RAPG	-339.7111* (-1.7244)	-758.8901*** (-2.5841)	-324.5890 (-1.0097)
INC	0.6970*** (27.9559)	0.5874*** (13.6995)	0.5814*** (11.9827)
POP	-0.0004*** (-4.8320)	-0.0006*** (-4.9908)	-0.0002 (-1.4413)
AVEPRICE	-388.8761*** (-8.2342)	-718.5565*** (-10.0539)	292.5191*** (2.8168)
PAYROLL	286.9544*** (28.2685)	329.6111*** (18.1735)	237.2016*** (17.3433)
FOOT	1845.632*** (2.6046)	-1927.810* (-1.9591)	3804.616*** (3.3333)
BASK	-1465.757*** (-3.1885)	2133.747*** (3.3299)	-2397.164*** (-3.0752)
HOCK	-2820.045*** (-7.0511)	-5134.821*** (-7.6895)	-1929.168*** (-3.4871)
AL	-2563.656*** (-7.5106)		

NEWSTAD	6058.387*** (10.9689)		4922.456*** (7.6198)
VRFPG	633.6051*** (3.0248)	586.8868** (2.0053)	1055.638*** .(3.4131)
VRAPG	-1424.382*** (-7.4491)	-1038.318*** (-4.0389)	-2086.422*** (-6.8573)
DIV	318.1355 (0.9784)	667.5239 (1.3977)	-141.3857 (0.7406)
INTLEAGUE	820.6859 (1.3034)	-207.3719 (-0.2408)	2259.275*** (2.7141)
R^2	0.6278	0.6380	0.6763
Adj. R^2	0.6234	0.6295	0.6694

T-stats are given in parentheses. *** Denotes significance at below 1%, ** denotes significance at below 5%, and * denotes significance at below 10%.

difference. The two new stadiums for 2001 contributed over 4000 new fans for each game and the dummy variable was found to be significant.

Payroll took the expected positive sign and was significant across all regressions. Additional salary dollars appear to have a larger impact on attendance in the American League than in the National League. Average ticket price was found to be significant and negative for all of major league baseball. For the individual league regressions, however, the sign on average ticket price for the National League was found to be positive. Similar results for the other variables were found when ticket price was not included in the regression. Ultimately, it was decided to leave average ticket price in the demand model even with this unexpected NL result.

Baseball fans also care about the opponent. Visiting runs for per game was found to be positive and significant and visiting runs against per game was found to be negative and significant. Using visiting runs scored as a proxy for quality of the opponent, this suggests that fans prefer to see good teams, those that score more often and give up fewer runs, to bad teams. Other factors that matter about the opponent are the main focus of this paper. The impact of interleague play and the unbalanced schedule are addressed in the next section.

III. INTERLEAGUE PLAY, THE UNBALANCED SCHEDULE, AND THE YANKEES EFFECT

The Major League Baseball regression in Table I shows that both the interleague game dummy and the divisional game dummy have positive coefficients. Both, however, are statistically insignificant. Taken alone, this could suggest that the cost-saving nature of these scheduling policies is enough to make these changes beneficial to baseball. In looking at the leagues individually, however, other implications arise.

For the interleague dummy, in the American League regression, the coefficient was found to be negative (-207.37), but not significant. On the other hand, for the National League, the interleague dummy has a much larger positive coefficient (2,259.27) and is significant at the one percent level. The question arises as to why interleague games are a positive for National League team fans and a negative for American League team fans? To answer this question, we broke the sample into American and National League regressions and the interleague and division dummies were created to allow the Yankees to have a separate effect. In recent years, the Yankees have been the dominant team and historically have won the most championships. There are large numbers of Yankee fans across the country and some teams, for example San Diego, have started raising ticket prices for games against the Yankees.

To illustrate the effect that the New York Yankees had on National League attendance, the interleague dummy was broken into two parts. One variable represents interleague games where NL teams played the Yankees (INTNYY) and the other variable represents NL interleague games versus all other AL teams (INTOTHER). The results are reported below in Table II.

The dominant effect on interleague game attendance in the National League comes from the NL teams who played the Yankees. Overall, within the 2001 sample, the Yankees games increased home attendance by over 17,000 fans. This increase is significant at the one percent level. The other interleague games still had a positive effect on attendance, but it was much smaller (less than 1,100 fans), and was not significant. Coupled with the previous results for the American League, where interleague games decreased attendance, albeit not significantly, it appears that the major gains from interleague play are associated with a very small subset of games, specifically, games against the Yankees.

The effect of the unbalanced schedule is also dependent upon the Yankees. Table I shows that divisional games barely increase attendance for Major League Baseball as a whole. In the National League, the effect is negative and insignificant, while in the American League it is positive and insignificant. Applying the same rationale as interleague play, the AL regression was run with two separate variables for divisional games. One was the New York Yankee divisional games (DIVNYY) and the other was all other divisional games in the AL (DIVOTHER). The results are reported in Table III.

Divisional games appeared to help only the teams in the AL East. The New York Yankee divisional games are found to have a positive and significant effect on attendance. Each Yankee game brought in more than 6,000 additional fans to other AL east teams. Other divisional games are found to have an insignificant effect on attendance.

IV. CONCLUSIONS AND DISCUSSION

The offices of Major League Baseball made two major changes to their schedule in recent years. In 1997, interleague play was started and in 2001, an unbalanced schedule was introduced. Both policies were introduced for specific goals, one on the cost-side and the other on the demand-side. Both changes

Table II:
National League Regression with Separate Yankees Interleague Term

Variable	Coefficient (T-stat)
Constant	-21291*** (-7.4433)
OPDAY	31936.26*** (8.8800)
APRIL	-5451.704*** (-7.8449)
MAY	-3892.091*** (-6.6282)
JUNE	-355.6535 (-0.6238)
AUG	-1857.024*** (-2.9612)
SEPT	-2492.935*** (-3.6737)
OCT	-6107.041*** (-3.5078)
MON	-280.87 (-0.3391)
TUE	-343.7825 (-0.5420)
THUR	209.1054 (0.3291)
FRI	4023.264*** (6.2265)
SAT	8325.413*** (12.3393)
SUN	5172.589*** (7.9798)
RFPG	4020.683*** (8.2338)
RAPG	-351.8842 (-1.1062)
INC	0.5880*** (12.4821)
POP	-0.0002* (-1.7886)
AVEPRICE	285.1692*** (2.7579)
PAYROLL	246.0599*** (18.8085)
FOOT	3423.105*** (3.0697)
BASK	-2546.736*** (-3.2916)
HOCK	-2162.182*** (-4.0302)
NEWSTAD	4973.241*** (7.6733)
VRFPG	964.7248*** (3.1373)

VRAPG	-1914.535*** (-6..4793)
DIV	-146.6900 (-0.3430)
INTNYY	17011.32*** (6.8413)
INTOTH	1077.968 (1.4087)
R^2	0.6884
Adj. R^2	0.6815

T-stats are given in parentheses. *** denotes significance at below 1%, ** denotes significance at below 5%, and * denotes significance at below 10%

Table III:
American League Regression with Separate Yankees Divisional Term

Variable	Coefficient (T-stat)
Constant	6379.895* (1.7609)
OPDAY	18620.51*** (6.3810)
APRIL	-6669.107*** (-8.4178)
MAY	-4814.120*** (-6.1841)
JUNE	-2112.906*** (-2.9423)
AUG	-1715.111** (-2.2361)
SEPT	-5269.054*** (-6.3755)
OCT	-7429.391*** (-5.2861)
MON	932.1251 (0.9846)
TUE	-1063.622 (-1.5701)
THUR	738.5736 (1.0410)
FRI	5261.450*** (7.0710)
SAT	8155.316*** (11.3124)
SUN	5313.431*** (7.0891)
RFPG	1331.551*** (3.9457)
RAPG	-657.9120** (-2.2528)

INC	0.6101*** (14.4414)
POP	-0.0006*** (-4.7118)
AVEPRICE	-738.9245*** (-10.3647)
PAYROLL	332.4359*** (18.5295)
FOOT	-2252.308** (-2.3662)
BASK	2137.660*** (3.4059)
HOCK	-5196.548*** (-7.9770)
VRFPG	-297.9393 (-0.9931)
VRAPG	-820.7146*** (-3.1637)
DIVNYY	6267.063*** (7.0126)
DIVOTHER	646.5484 (1.3258)
INT	94.5322 (0.1098)
R^2	0.6527
Adj. R^2	0.6442

T-stats are given in parentheses. *** denotes significance at below 1%, ** denotes significance at below 5%, and * denotes significance at below 10%

could reduce travel costs by playing more games in the same geographic region. Interleague play would allow for teams in the same area, but different leagues, to play each other. This would likely generate fan interest in cities with two teams, such as New York and Chicago, but the bigger question is whether interleague play would interest the fans of teams without natural interleague rivals. The unbalanced schedule was intended to increase attendance by scheduling more games against division rivals. Attendance might increase for these games, regardless of record, because fans know more about the players and the history of these common opponents. If fans grow tired of seeing the same teams all the time, this policy could have the reverse effect.

A demand regression was specified for game-to-game attendance in Major League Baseball. A variety of explanatory variables are included to account for a large number of factors that have an impact on the attendance for any given game. The results are as expected for most variables. Weekend days, summer months, runs scored, income per capita, and team payroll all had positive impacts on attendance.

Dummy variables are included in the regression for interleague games and for divisional games. Regressions were run for all of Major League Baseball and for the American League and National League individually. For all of baseball, these variables are found to be insignificant, which suggests that the cost-reductions of these policies may be enough to justify them. Upon examination of the individual leagues, however, what is driving the impact on attendance becomes much clearer.

In the National League, interleague games have a large positive and significant effect, while divisional games have a negative, but insignificant, effect. In the American League, divisional games have a positive effect and interleague games have a negative impact on attendance, although both are insignificant.

The common element to the positive effect on attendance for interleague games in the NL and divisional games in the AL is the New York Yankees. Going into the 2001 season, the Yankees had won three of the four previous World Series championships, led in merchandise sales, and had fans all around the country. The regressions were run again, this time separating the Yankees games from the non-Yankees games for interleague games in the National League and divisional games in the American League. In both instances, attendance increases are found to be positive and significant for Yankees games and insignificant for the other games. Interleague play with the Yankees led NL teams to see an increase in attendance of over 17,000 fans, while divisional games for the AL East teams against the Yankees led to over 6,000 more fans. It appears the change in scheduling did not create an increase in demand for major league baseball in 2001, but having the Yankees as your opponent did lead to increased attendance and revenues.

ENDNOTES

1. Models were specified with both win percentage and RFPG and RAPG and also win percentage by itself. The main conclusions of this paper remain the same under these specifications as the levels of significance of the variables of interest do not change and the coefficients change only slightly under any of these specifications. To view these results, please contact the authors.
2. The model was also run assuming that price is endogenous in the system. A seemingly unrelated regression model in the form of Jones, Ferguson, and Stewart (1988) was run for baseball. The results are similar to the results found here for all of the independent variables.

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THE JOURNEY OF WOMEN UP THE CORPORATE LADDER: A STUDY OF THE REPRESENTATION OF WOMEN IN TOP CORPORATE POSITIONS IN NEW YORK STATE

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ABSTRACT

In order for women to be equally represented on corporate boards, they must first be represented equally among officers and other managerial occupations within companies. The low percentage of women on the board of directors is a reflection of the low number of women in the highest positions within New York State corporations. This paper explores the factors that influence whether or not there is female representation in the top levels of New York State publicly traded corporations as well as the level of representation of women in these corporations. It appears that in 1999, women are still under-represented in the highest positions in business in New York State. Only 11.6 percent of corporate officers and a mere 6.3 percent of directors in this sample are female. However, the analysis suggests that women may be promoted at higher rates than men in some male-dominated industries such as high-tech industries, while it appears that women are not represented at higher rates in top corporate offices among corporations in female-dominated industries, including retail and services. Region and industry do not seem to play a large role in the representation of women. Finally, the research suggests that there is a positive relationship between the total number of officers within a corporation and the percentage of female officers. The same relationship holds with the total number of directors and the percentage of female directors in New York State based corporations. This would indicate that, overall, the representation of women at lower positions within a firm influences their representation at higher levels.

INTRODUCTION

Over the last forty years, there has been a growing awareness of the difficulties that women face in the workplace as they have been increasing their share of labor market participants. Some of the earliest research to explore the inequalities that women face in the workplace was focused on pay differentials within the same occupation. Much of this research suggested that women were being paid

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less than men with the same job title. In an attempt to resolve this discrepancy, the Equal Pay Act was passed in 1963[1]. This law required that men and women be paid equally for the same job. However, as pay disparities persisted between genders, research began to focus on occupational segregation or crowding of women into "female" occupations as an explanation for these differences. Results that suggested women who were crowded into these occupations were paid less than men in similar types of jobs led public policy to move toward a concept of comparable worth in the late 1970's and 1980's in order to equalize these pay disparities. This policy goes beyond equal pay for equal work and requires women to be paid the same as men for work of equal worth to the employer.

This new view of how women should be compensated for their workforce participation addresses one of the major drawbacks of the Equal Pay Act. The Equal Pay Act does not deal with the effects of crowding of women into "female" occupations since it only explores wages within a particular job title. Through comparable worth, women are paid the same as men who perform work of equal worth; therefore, the value of work, not the occupation itself, is the major factor in determining the wage. Although comparable worth has yet to be implemented on a national level, research suggests that it has been successful on both state and local levels in equalizing wages earned by men and women.[2] Nonetheless, comparable worth, although a more effective policy than equal pay, does not address the problem of segregation within occupations. Comparable worth falls short of helping women advance past the "glass ceiling", an invisible barrier that prevents women from reaching the top of the corporate ladder. An examination of the representation of women in the highest corporate positions is necessary to determine the real effects of this glass ceiling. There has been some recent research in this area. Most of this research, however, examines the overall under-representation of women in top corporate offices among corporations in general. One area in which there has not been extensive research is the characteristics of the companies that have women in top corporate positions to determine what types of corporations are more likely to hire or promote women to top positions. Often the justification for the unequal promotion of women is that women do not have the experience, education, and qualifications that men have. If this were the case, we would expect that there would be no difference in the representation of women in top corporate positions across different types of corporations because if women truly did not have the qualifications necessary for top positions they would not hold these positions in any corporations.

This paper will examine the characteristics of corporations to determine whether there are differences between corporations with female representation in top positions and those without. This will be done by examining characteristics of all of the publicly traded corporations that were based in New York State in 1999 (1068 corporations). We will examine various factors that may influence the rates of representation of women among corporate officers and directors including industry, region, and firm size. Logistic regressions will be employed to analyze the data and determine the degree of influence each corporate characteristic has on the representation of women in top positions.

Overall, women appear to be underrepresented both on the boards of directors and among officers in New York State Corporations in that they represent a far lower percentage than men among both directors and officers. This research also suggests that women are represented among officers at different rates based on the region in which the company is headquartered. While the percentage of female employees is lower at all levels in high tech companies, this analysis suggests that the relationship between high tech companies and the representation of women among officers and directors is not statistically significant. Additionally, in female dominated industries, there again appears to be no significant relationship between industry and the representation of women. Finally, it appears that the number of female officers has a statistically significant influence on the representation of women on the board of directors and the number of female directors has a statistically significant influence on the representation of women among officers within New York State corporations.

LITERATURE REVIEW

Most studies on employment differentials between men and women focus on differences in pay by gender. A relatively recent group of articles attempts to examine differences in promotional rates and discrimination within individual occupations. Most research on this topic is limited to studies of a single industry or a handful of corporations. Very few studies examine promotional rates across different industries and occupations.

One of the earliest studies on promotional rates within corporations is entitled “Men and Women in Fiduciary Institutions: A Study of Sex Differences in Career Development” (Robert Cabral, et al, 1981). This research examined the impact of employment decisions on the pattern of occupational distribution and salaries. The research concludes that there are gender differences in both wages and job assignments, which cannot be explained by differing characteristics of male and female workers. As a result, the authors conclude that the differential in both salary and job assignments can probably be attributed to gender discrimination.

Another study that explores gender differences in evaluations for promotional opportunities is entitled “Subtle Gender Bias in the Assessment of Managerial Potential” (Ted H. Shore, 1992). This study examines a group of 375 men and 61 women between 1980 and 1985. Assessments of all individuals in the sample were conducted examining intellectual ability, performance and interpersonal skills, and overall management potential. This research suggests that men and women are promoted at almost the same rate despite women receiving higher ratings on average on these evaluations. Another disparity is that evaluators seem to emphasize all variables equally when evaluating men for promotion, whereas in the evaluation of women the categories on which they generally score higher, performance skills, tend to receive less emphasis than other variables. Overall, this study finds that there is a gender bias in the evaluation of women with regard to managerial potential and promotional opportunities.

One study of promotional rates that examines data on a variety of corporations and industries was conducted by Craig A. Olsen and Brian E. Becker (1983). This study examines promotional rates within occupations based on data from the Quality Employment Panel from 1973-1977. Data included individual occupations and wages for the four-year period. They tested the hypothesis that women are discriminated against in the promotion process in two ways, and that this discrimination adversely affects their wages. The first explanation is that women are not paid at the same rate as men in spite of being equally represented across different occupations. The second explanation is that women are not promoted at the same rate as men and, as a result, their wages are lower. While the research found little evidence to support the first explanation, the authors found that women were not evaluated for promotion based on the same standards as men and, therefore, experienced lower rates of promotion. The data also suggest that a portion of the gender wage differential can be attributed to lower promotional rates that women experience. Overall, it appears that women's promotional rates and resulting wages are adversely influenced by discrimination that women experience in their evaluation for promotion.

In a more recent study, Rudolph Winter-Ember and Joseph Zweimillec (1997) use Austrian micro census data to determine whether gender influences the likelihood of promotion. This study overcomes many of the shortcomings of earlier studies. It looks at statistics across different occupations and has a larger sample size than most other studies. The research concludes that unequal career advancement is a major factor contributing to gender inequities in the labor market. This study further demonstrates that differences in characteristics can explain only a small portion of the inequity in gender distribution across job titles. In conformity with the earlier studies, the authors argue that the difference in the representation of women in different job titles is due to discrimination.

Within the last few years there has been further research on this topic, Seymour Spilerman and Trond Peterson (1999) analyzed data from a large insurance company to determine differences in promotional rates by gender. They divided cases of promotion into two groups, those resulting from a vacancy and those based solely on merit. The data they had access to permitted them to control for several potential influential variables such as ethnicity, education, age, and seniority. Based on regression analysis, they determine that there is a difference in the attainment of promotions based on gender even after controlling for these factors, namely that women are promoted at lower rates than men are.

Another article, entitled "Managerial Momentum: A Simultaneous Model of the Career Progress of Male and Female Managers", looks exclusively at managerial promotion rather than promotion across different levels within a company as the previous studies have done (Kathleen Cannings and Claude Montmarquette, 1991). This study examines the factors that influence promotional rates of middle managers in a large corporation in Canada. The research determines that for women there is "a significant simultaneous interaction of performance, ambition and rewards". However, despite this interaction, women do not experience higher promotional rates because once a woman receives an offer of promotion she is less likely to demand subsequent promotions. This study suggests that, despite having lower performance scores than women, men are offered more promotions per year of service. Men overcome differences in performance and formal bidding through the use of informal networks through which they have an opportunity to discuss promotional opportunities with their superiors and, therefore, are offered more promotions than women.

All of the aforementioned studies have discussed the existence of discrimination in the evaluation and recommendation of employees for promotion. A study of promotion within financial institutions, which was conducted by David R. Jones and Gerald H. Makepeace (1996), contradicts these previous studies. It concludes that discrimination does not play a major role in inequities in the promotion process. This study examined a sample of 4,379 full-time employees in a large financial institution in Great Britain. The authors find that women are evaluated by more difficult standards than their male counterparts when they are being considered for a promotion. This difference does not, however, appear to explain the majority of the difference in promotional rates of men and women. The authors find that a large portion of the difference in promotional rates of men and women is based on differing characteristics of men and women with respect to labor market participation. This study finds that there would be a two-percentage point differential in the representation of women among managers if they had been evaluated based on the same standards as men. If women had the same workplace experience as men, however, their representation among managers would rise by 17 percentage points. These results suggest that discrimination does not play a major role in the under-representation of women among managers as is suggested by most other studies on promotional rates and the representation of women in the top positions in business.

Some of the previous studies have examined promotion of women at all levels within corporations while others have exclusively looked at managers. A 1990 study of the legal profession conducted by Stephen Spurr found that women are less likely to be promoted to partner in a law firm than equally qualified men. This research examined two cohorts of lawyers: one that entered law firms between 1969 and 1973 and a second that entered law firms in 1980. The study followed both cohorts through 1987. The data indicates that women were half as likely to be promoted to partner as men were during this period. The conclusion of this research is that there is not a significant difference in attributes or productivity of male and female lawyers that could explain this difference. The data did reveal that a higher standard of promotion applies to women than men. Estimates are that 56-72 percent more women would have been promoted if they were rated by the same criteria as men. As was the case in many of the previously discussed studies, the results suggest that discrimination is a probable explanation for the difference by gender in the rate of promotion to partner among law firms in this sample.

While most previous studies have used regression analysis to analyze promotional rates within occupations, some studies rely exclusively on descriptive statistics to explore the representation of women among managers, officers, and directors. In 1972, only 20 percent of managers in the United States were women (Blau et al., 1998); in 1995, that number had grown to 43 percent of all managerial positions (Federal Glass Ceiling Commission, 1995). These figures show that there has been a significant improvement in the representation of women in management; however, women are still significantly under-represented in the top management positions. In 1995, women comprised only 3-5 percent of senior management in the Fortune 1000 industrial and Fortune 500 service corporations (Blau et al., 1998). These findings would suggest that women are not being promoted at the same rates to positions at the top of the corporate ladder as they are at lower management positions.

Another study conducted by Catalyst, a not-for-profit research and advisory corporation examines the representation of women in the most influential positions in business (Catalyst: Corporate Officers, 1998). This study looks at the representation of women among officers of the Fortune 500 corporations. Overall, the data reveal that there were female officers in 75 percent of the Fortune 500 companies; however, they represented only 11.2 percent of all corporate officers in these companies in 1998. Additionally, only .8 percent or 4 out of 500 chief executive officers in these companies were female. The diminishing share of women as we proceed up the corporate ladder suggests unequal rates of promotion.

A second important study conducted by Catalyst examined the representation of women on boards of directors (Catalyst: Directors, 1998). The preceding studies of female representation at differing levels of management do not examine the presence of women on corporate boards. Becoming a director of a corporation is not necessarily a position that would be in the line of promotional opportunities within a corporation since it is an elected position; nonetheless, it provides important insight into the role of women at the most influential levels within the corporate world. This study examined the boards of directors of the Fortune 500 corporations. The data revealed that 86 percent or 429 out of the top 500 revenue-producing corporations in the United States had at least one female director. Although the vast majority of the Fortune 500 boards have at least one female director and 38 percent have more than one female director, a mere 11.1 percent of the total number of board seats are occupied by women, translating into only 671 female board members out of 6,064 total seats.

According to Catalyst, over the past five years there has been significant progress in the representation of women on the boards of directors of the Fortune 500 companies. There has been a 17 percentage points increase in the share of Fortune 500 companies with at least one woman on the board from 69 percent in 1993 to 86 percent in 1998. Catalyst's research also shows that among the Fortune 500 companies, those corporations with the highest revenues have a much higher proportion of female directors than companies with lower revenues (Catalyst: Directors, 1998).

Some of the limitations of the Catalyst studies are that they only examine Fortune 500 corporations. These are the largest corporations in the country, and, as a result, it is difficult to generalize the results to all corporations since the size of the corporation may be a major influence on the representation of women. This study includes revenues of the corporations in the analysis; however, they imply that the relationship between the presence of female directors and officers and increasing revenues is a causal one. I doubt that this is the case because the revenues of a corporation do not change overnight because of a change in the composition of the board, but rather in most corporations revenues increase gradually as result of years of growth and corporate decisions. It would take time for the influence of one person to have any large affect on the revenues of the corporation and without variables measuring how long a woman has been represented in the corporation and the amount of the corporation's revenues before that woman was added to the board or officers, I believe the implication of the causal relationship is incorrect. Instead, I believe revenues work better as a measure of the size of the firm. Catalyst also did not examine the relationship between female representation among officers and that of women on the board of directors.

EXPLANATION OF PRESENT RESEARCH

All of the aforementioned studies provide important insights into the differences in promotional rates by gender and the representation of women in top corporate offices. There are, however, some limitations. One limitation of these studies is that they do not examine the influence of industry on promotional rates and representation of women. There may be differences in the representation of women in male-dominated industries since there are fewer women at all levels within those corporations and as a result, there are fewer female candidates for promotion. In addition, women may be more likely to be discriminated against in those industries where they are represented in very low numbers. Further research is needed to examine the representation of women across different industries.

Since most of these studies rely on data from a small sample of corporations or industries, they may not reflect promotional rates and representation of women across different sectors. Furthermore, it may be difficult to conduct similar studies across a broader range of companies and industries, since the studies discussed here present data on industries and corporations with very clearly defined job titles, classes, and promotion levels. In these corporations, it may be more difficult to discriminate against women since the path of promotion within the corporation is transparent. It may be more difficult to detect disproportionate representation of women caused by unequal promotional rates by gender in industries and corporations with less clearly defined promotional levels since the differences between men and women may not be as obvious. Another difficulty with studies that exclusively examine managers is that none of them makes a distinction between managers and officers. As a result, we cannot compare the representation of women in the highest and most influential positions within corporations relative to those in lower levels of management. Further research is needed in order to determine the representation of women in all types of corporations and to identify those levels within corporations at which disparities in promotional rates are greatest.

Some of these studies explore the representation of women among corporate officers and directors; however, to date there has not been a comprehensive study of the representation of women among officers and directors over a broad range of companies, which are heterogeneous in a range of different characteristics. For example, the Catalyst study only examines Fortune 500 companies, which share many of the same characteristics with regard to size, revenues, etc. Additional research is needed to explore the representation of women in top corporate officers among a varied sample of corporations. Also, further research is needed to examine whether those corporations that do have women in top corporate positions have different characteristics than those corporations without women in top positions. This would provide insight into the types of corporations that may be more likely to promote women to top positions or elect women as directors. This paper will examine the representation of women in top corporate offices over a broad range of heterogeneous companies. Additionally, it will explore differences in characteristics such as industry, region, firm size, and revenues among corporations with women in top positions versus those with only men in these positions.

DISCUSSION OF DATA

This study will use data on female officers and directors in New York State corporations, as well as data about these companies in order to determine the representation of women in top corporate offices and the differing characteristics of companies with women in these positions as opposed to those without. The research uses data on the population of New York State public corporations in 1999.

The data for this research was gleaned from both Moody's Company Data and Standard and Poors' Compustat databases. Both sources include information about all of the publicly traded corporations in the United States.

Moody's database was the source of the list of names of the directors and officers of these corporations as of August 31, 1999. The list of female directors and officers was compiled by reviewing the names of directors and officers and determining the number of women that were represented in each company. In the case of ambiguity, the gender was confirmed either through the company's SEC filings or through direct contact with the company. The list of corporate officers from Moody's included all officers who are chosen by each corporation to be listed in any of the company's SEC filings, in general this includes only management at or above the level of senior and executive vice presidents of the corporation. Most corporations have between 4 and 6 officers with 75 percent of corporations having 7 or fewer officers. The range, however, goes as high as 44 with one corporation having this number of officers.

Standard and Poors' Compustat database was the source of data on the SIC Codes, region and revenues of each corporation. The SIC codes are used to classify the companies into various industries. Dummy variables were included for all of the major industry classifications as well as high-tech companies and companies in female dominated industries. High-tech companies were determined by including companies that were described as machinery, electronic, computer and engineering by their SIC codes. High tech companies comprise 17.3 percent of the corporations in this sample. Female dominated industries included service and retail industries, which were identified by the Bureau of Labor Statistics as having more than 50 percent female employees; 15.9 percent of corporations in this sample are in female dominated industries. The major industry classification called "Finance, Insurance and Real Estate" (FIRE) contained 48.1 percent of all companies in the sample; therefore it was broken down further into subcategories: Depository Institutions, Real Estate, Insurance Agents, Brokers and Holding and Other Investment Offices. Categories were also included for Business Services, Electrical and Other Equipment and Chemical and Allied Products.

The corporations were divided into five regions, Long Island, Manhattan, New York City Boroughs (other than Manhattan), Westchester and Upstate New York. Upstate New York was also divided into 4 sub-regions: Syracuse, Ithaca, Buffalo, and Albany. The area code of the company was used to place each company into a region. Dummy variables were used to indicate the region in which the company belonged. Dummy variables were also used to classify the revenues of each company. Because of the range in revenues among corporations, (a difference of over $300 million between the smallest and largest) the data were divided into three categories based on revenues. Natural breaks in the range of revenues were used to group the corporations into three groups with approximately the same number of corporations in each. The categories are: high revenue, which includes any company with over $42.5 million of revenues; medium revenue, which includes any company with between $5.75 and $42.5 million in revenues; and low revenue, which included companies with revenues of $5.75 million or less.

Descriptive Analysis
General Data on New York State

Table 1			
	Overall percentage of female officers/directors	**Percentage of corporations with at least one female officer/director**	**Percentage of corporations with multiple female officers/directors**
Officer	11.6	42.0	14.4
Director	6.3	33.3	10.4

The data in table 1 demonstrates that, by and large, New York State based public corporations have very few women on the board of directors. Only 33.3 percent of these 1068 corporations have at least one female director. While the percentage of corporations with at least one female board member illustrates the problem, it understates the absence of women on corporate boards. In 1999, only 10.4 percent of these corporations had multiple female directors. Despite an overall decline in occupational segregation, in 1999 a mere 6.3 percent of corporate board members are female.

In addition, the percentage of female officers is low within these corporations. Only 42.0 percent of companies have at least one female officer and women represent only 11.6 percent of all officers. Only 14.4 percent of corporations have multiple female officers. The small share of female officers makes it more difficult for a corporation to have female candidates with the qualifications necessary to be elected to the board of directors.

As the data in table 2 demonstrates, Long Island has considerably lower representation of women on boards of directors than any other region with only 4.8 percent of all directors being women and 27.8 percent of corporations having at least one woman on the board. In contrast, in the New York City Boroughs (excluding Manhattan), there is a much higher representation of women on boards of directors

Regional Differences

Table 2

	Overall percentage of female officers	Overall percentage of female directors	Percentage of corporations with at least one female officer	Percentage of corporations with at least one female director	Percentage of corporations with multiple female officers	Percentage of corporations with multiple female directors
Manhattan	13.1	6.3	49.0	33.5	17.3	11.0
Other Boroughs	12.9	8.8	40.5	37.8	11.8	13.5
Westchester	10.5	7.1	40.5	39.7	13.8	8.6
Upstate	10.3	6.7	32.9	39.2	11.9	12.6
Long Island	8.1	4.8	29.8	27.8	9.1	4.0

with 8.8 percent of directors being female. In Westchester, 39.7 percent of all corporations have at least one female director. Moreover, on Long Island, there are no companies with more than two women on the board and only 4.0 percent of Long Island based corporations have multiple female directors; whereas, in New York City boroughs (excluding Manhattan) 13.5 percent of corporations have multiple female board members. Long Island is also the region with the lowest rate of female representation among corporate officers. Women represent only 8.1 percent of all officers in Long Island based companies.

Table 3

	Overall percentage of female officers	Overall percentage of female directors	Percentage of corporations with at least one female officer	Percentage of corporations with at least one female director
Syracuse	7.6	6.5	38.5	26.9
Buffalo	9.1	6.2	53.1	25.0
Albany	9.9	7.2	45.0	55.0
Ithaca	18.1	7.2	30.8	32.3

In the different regions of Upstate New York there also appears to be a range in the representation of women as seen in table 3. Only one-quarter of Buffalo based firms have at least one female director whereas more than half of the companies in Albany have some female representation on the board of directors (55.0 percent). Among officers, 30.8 percent of Ithaca corporations have at least one woman whereas in Buffalo 53.1 percent of corporations have at least one female officer. Looking at the total percentages of officers and directors who are female, Ithaca again stands out with 18.1 percent of officers being female which is almost double the average of the other Upstate regions. Among corporate directors, there is not a great difference among the different regions with a range of 6.2 percent to 7.2 percent of all directors being female.

On the whole, there appears to be a range in the representation of women on the board of directors and among corporate officers based on the region in which the company is located. The relationship between region and representation of women among both directors and officers will be tested with regression analysis to determine the presence of a statistically significant relationship between region and the representation of women in top corporate positions.

Differences by Industry

Table 4		
	Overall Percentage of female officers	**Overall Percentage of female directors**
Mining	0.0	0.0
Construction	7.1	0.0
Wholesale Trade	7.2	5.3
Manufacturing	7.9	6.4
Transportation	10.4	8.6
Business Services	11.6	5.2
FIRE	14.5	5.9
Retail Trade	16.9	10.0
Electrical Equipment	8.7	7.7
Chemical and Allied Products	10.9	11.5

There is a range in the representation of women in top corporate positions based on industry. As table 4 shows, values range from zero to 16.9 percent women among officers and zero to 10.0 percent among directors. It appears that those industries that have historically been male dominated (such as mining and construction) have the lowest rates of female representation; whereas traditionally female dominated industries such as retail, finance, insurance and real estate, and services have a higher percentage of women in top positions.

Table 5		
	Overall percentage of female officers/directors	**Overall percentage of female officers/directors**
Real Estate	11.7	4.3
Broker	7.3	9.1
Insurance Agent	11.1	6.8
Holding and Other Investment Services	18.1	4.7
Depository Institution	13.3	6.8

There is also a difference in the representation of women among officers and directors in subcategories of the finance, insurance, and real estate industry. Table 5 shows there is a range from

4.3 percent and 4.7 percent female directors in real estate and holding and other investment services companies respectively to over 9.0 percent female directors in brokerage companies, almost a 200 percent difference. Interestingly, brokerage companies have the highest percentage of female directors, but have the lowest percentage of female officers with only 7.3 percent. On the other hand, holding and other investment services have the highest percentage of female officers (18.1 percent), but one of the lowest percentages of female directors (4.7 percent).

MODELS AND RESULTS

More than half of the corporations in New York State do not have a single woman on the board of directors or among officers. As a result, I will be doing a two-pronged analysis of the data. First, I will use logistic regressions with a dependent variable, which is a dummy variable coded 1 if the corporation has at least one woman on the board and zero if there are no women on the board. The same analysis will be repeated using a dummy variable for whether or not a company has at least one woman among directors. Next, I will employ ordinary least squares regressions on the sample of corporations with at least one woman on the board and will use as a dependent variable the natural log of the percentage of female directors. The same analysis will be duplicated with the sample of corporations with at least one female officer using as the dependent variable the natural log of the percentage of female officers. By using this two pronged approach I will be able to isolate the differences in corporate characteristics that lead to female representation (using logistic regressions) as well as the marginal effects of each additional woman that is included on the board or among corporate officers (using ordinary least squares regressions). The analysis will explore the relationships between the dependant variables and industry, region, number of female officers, number of female directors and size of the company, as measured by both the total number of officers or directors, and revenues. In addition, to better clarify the influence of women on the board and among officers I have excluded mutual fund companies from this analysis. There are 159 mutual funds in the population of publicly traded companies, many are sponsored by the same parent company and often have the same directors and officers or a subset of the directors and officers of the parent company. The inclusion of these companies could bias the results because their inclusion would amount to counting the same company multiple times. It is more accurate to only include the parent companies in the analysis and exclude the individual mutual funds.

For all of the models, we are interested in both the level of significance and direction of the relationships, whether positive or negative. The following equations are used in the analysis of the variables previously discussed and the relationships that exist between them.

MODEL 1 – LOGISTIC REGRESSION DIRECTORS

$$\text{Logit(DD)}=\beta_0+\beta_1(\text{NFO})+\beta_2(\text{TND})+\beta_3(\text{MR})+\beta_4(\text{LR})+\beta_5(\text{W})+\beta_6(\text{BO})+\beta_7(\text{LI})+\beta_8(\text{A})+\beta_9(\text{I})+\beta_{10}(\text{BU})+\beta_{11}(\text{S})+\beta_{12}(\text{HI})+\beta_{13}(\text{BS})+\beta_{14}(\text{BR})+\beta_{15}(\text{TN})+\beta_{16}(\text{CA})+\beta_{17}(\text{CN})+\beta_{18}(\text{IA})+\beta_{19}(\text{MA})+\beta_{20}(\text{EE})+\beta_{21}(\text{MI})+\beta_{22}(\text{WT})+\beta_{23}(\text{DI})+\beta_{24}(\text{RE})+\beta_{25}(\text{HT})+\beta_{26}(\text{FI})$$

Where:

DD=Dummy Variable whether there is at least one female director
NFO=Number of Female Officers
TND=Total Number of Directors
MR=Medium Revenue
LR=Low Revenue
W=Westchester
BO=Boroughs
LI=Long Island
A=Albany
I=Ithaca
BU=Buffalo
S=Syracuse
HI=Holding and Other Investment Services
BS=Business Services
BR=Broker
TN=Transportation
CA=Chemical and Allied Products
CN=Construction
IA=Insurance Agent
MA=Manufacturing
EE=Electrical Equipment
MI=Mining
WT=Wholesale Trade
DI=Depository Institutions
RE=Real Estate
HT=High Tech
FI=Female Industries

Base Variables (For Dummy Variables)
Revenue: High Revenue
Region: Manhattan
Industry: Retail Trade

The results from this analysis reveal that whether or not a corporation has a female director is indeed influenced by the size of the board of directors, the size of the revenues of the company, as well as the number of female officers within the company. In this model, industry is not a significant predictor of whether a company will have a female director. The most important predictors are the total number of directors and the number of female officers. The addition of one director, all else constant, would translate increase by 1.3 times the odds[3] that there will be at least one woman on the board of directors. For every additional female officer, all else constant, the odds of having a female director are doubled. The final significant variable in this equation is whether the company has medium revenues (between $5.75 and $42.5 million). The analysis reveals that a company with medium revenues is 50 percent less likely to have female representation than other corporations, all else constant.

Logistic Regression Dependent: Female Director Dummy Variable
Deviance:908.11 d.f.:882
**** denotes highly statistically significant variable * denotes statistically significant variable**

Variable	Coefficient	Standard Error
**Constant	-3.182	0.426
** Total Number of Directors	0.251	0.031
**Number of Female Officers	0.701	0.101
**Medium Revenues	-0.739	0.216
Albany	0.829	0.437
Westchester	0.488	0.260
Low Revenues	0.345	0.220
Boroughs	0.504	0.438
Business Services	-0.426	0.386
Broker	0.552	0.581
Female Industries	0.263	0.395
Construction	-5.981	9.093
Chemical and Allied Products	-0.260	0.398
Ithaca	-0.309	0.594
Manufacturing	0.190	0.376
Insurance Agent	0.445	0.897
Electrical Equipment	-0.190	0.454
Mining	-0.522	1.323
High tech	-0.114	0.290
Buffalo	-0.135	0.351
Long Island	0.071	0.237
Wholesale Trade	0.138	0.526
Transportation	0.421	0.437
Holding and Other Investment Company	0.024	0.488
Real Estate	-0.011	0.588
Syracuse	0.005	0.488
Depository Institutions	0.004	0.432

Model 2 - Logistic Regression Officers

$$Logit(DO)=\beta_0+\beta_1(MR*TNO)+\beta_2(LR*NFD)+\beta_3(LR*TNO)+\beta_4(TNO)+\beta_5(NFD)+\beta_6(MR)+\beta_7(LR)+\beta_8(A)$$
$$+\beta_9(W)+\beta_{10}(BO)+\beta_{11}(LI)+\beta_{12}(I)+\beta_{13}(BU)+\beta_{14}(S)+\beta_{15}(HI)+\beta_{16}(BS)+\beta_{17}(BR)+\beta_{18}(TN)$$
$$+\beta_{19}(CA)+\beta_{20}(CN)+\beta_{21}(IA)+\beta_{22}(MA)+\beta_{23}(EE)+\beta_{24}(MI)+\beta_{25}(WT)+\beta_{26}(DI)+\beta_{27}(RE)+\beta_{28}(HT)+\beta_{29}(FI)$$

Where:

DO=Dummy variable whether there is at least one female officer

MR*TNO=Interaction term Medium Revenue * Total Number of Officers

LR*NFD=Interaction term Low Revenue * Number of Female Directors

LR*TNO=Interaction term Low Revenue * Total Number of Officers

TNO=Total Number of Officers

NFD=Number of Female Directors

MR=Medium Revenue

LR=Low Revenue

A=Albany

W=Westchester

BO=Boroughs

LI=Long Island

I=Ithaca

S=Syracuse

HI=Holding and Other Investment Services

BS=Business Services

BR=Broker
TN=Transportation
CA=Chemical and Allied Products
CN=Construction
IA=Insurance Agent
MA=Manufacturing
EE=Electrical Equipment
BU=Buffalo
MI=Mining
WT=Wholesale Trade
DI=Depository Institution
RE=Real Estate
HT=High Tech
FI=Female Industries

Base Variables (For Dummy Variables)

Revenue: High Revenue

Region: Manhattan

Industry: Retail Trade

Logistic Regression Dependent: Female Officer Dummy Variable
Deviance: 937.57 d.f.:881
**** denotes highly statistically significant variable * denotes statistically significant variable**

Variable	Coefficient	Standard Error
**Constant	-3.183	0.417
**Medium Revenue	-0.779	0.199
**Number of Female Directors	0.666	0.081
**Total Number of Officers	0.250	0.030
*Albany	0.887	0.436
*Westchester	0.504	0.254
Low Revenue	0.373	0.202
Holding and Other Investment Services	-0.558	0.380
Boroughs	0.548	0.437
Business Services	-0.414	0.384
Broker	0.553	0.579
Transportation	0.414	0.436
Long Island	0.167	0.233
Chemical and Allied Products	-0.266	0.395
Female Industries	0.264	0.392
Construction	-5.965	9.118
Insurance Agent	0.435	0.895
Manufacturing	0.181	0.375
High tech	-0.136	0.289
Electrical Equipment	-0.198	0.453
Ithaca	-0.253	0.591
Mining	-0.517	1.323
Wholesale Trade	0.109	0.525
Syracuse	0.049	0.486
Depository Institutions	-0.031	0.430
Real Estate	0.016	0.584
Buffalo	-0.007	0.344

The results from this analysis reveal that as with directors, revenue is a significant predictor. The total number of officers and number of female directors and two regions, Albany and Westchester, are also significant predictors. Once again, industry is not a significant predictor of female representation.

For every additional officer a company has, its odds of having at least one female officer increase by 1.3 times and for every additional female director a company has, its chances of having a female officer increase by 1.9 times, holding other variables constant. A company's location is also a significant predictor with companies in Albany being 2.4 times more likely to have at least one female officer and those located in Westchester being 1.7 times more likely to have female representation among officers. Finally, as was the case with female directors, whether a company has medium revenues is a significant predictor of whether there is female representation among officers, with these companies being 50 percent less likely to have female representation.

Next, we will limit our sample to those companies within New York State that have at least one female officer or director in order to ascertain what factors are significant predictors of having an increased number of women in top offices within these companies. In this case we will use a natural log transformation of both the dependent variables, the percentage of female directors and officers and several independent variables, the number of female officers and directors and total number of officers and directors because this transformation approximates a normal distribution of the data which is one of the assumptions of ordinary least squares regression. In addition, by using the percentage figure as the dependent variable rather than the absolute number, we are adjusting for the potential influence of women. A corporation with one female director on a board of five members would translate into potentially more influence for that one woman, as compared to a corporation with twenty total directors and one woman on the board.

MODEL 3 - ORDINARY LEAST SQUARES REGRESSION DIRECTORS

$$LNPFD=\beta0+\beta1(LNNFO)+\beta2(LNTND)+\beta3(MR)+\beta4(LR)+\beta5(A)+\beta6(W)+\beta7(BO)$$
$$+\beta8(LI)+\beta9(I)+\beta10(BU)+\beta11(S)+\beta12(HI)+\beta13(BS)+\beta14(BR)+\beta15(TN)+\beta16(CA)+\beta17(IA)+\beta18(MA)$$
$$+\beta19(EE)+\beta20(WT)+\beta21(DI)+\beta22(RE)+\beta23(HT)+\beta24(FI)$$

Where:

LNPFD=LN(Percent Female Directors)
LNNFO=LN(Number of Female Officers)
LNTND=LN(Total Number of Directors)
MR=Medium Revenue
LR=Low Revenue
A=Albany
W=Westchester
BO=Boroughs
LI=Long Island
I=Ithaca
BU=Buffalo
S=Syracuse
HI-Holding and Other Investment Services
BS=Business Services

BR=Broker

TN=Transportation

CA=Chemical and Allied Products

IA=Insurance Agent

MA=Manufacturing

EE=Electrical Equipment

WT=Wholesale Trade

DI=Depository Institutions

RE=Real Estate

HT=High Tech

FI=Female Industries

Base Variables (For Dummy Variables)

Revenue: High Revenue

Region: Manhattan

Industry: Retail Trade

Ordinary Least Squares Regression Dependent: LN(Percent Female Directors)
Adjusted R-squared: .44
**** denotes highly statistically significant variable * denotes statistically significant variable**

Variable	Coefficient	Standard Error
**LN(Total Number of Directors)	-0.835	0.087
**LN(Number of Female Officers)	0.195	0.057
**Long Island	-0.257	0.097
*Albany	-0.384	0.184
*Real Estate	-0.486	0.248
Westchester	-0.168	0.089
Chemical and Allied Products	0.237	0.139
Depository Institutions	-0.243	0.146
Female Industries	-0.226	0.136
Transportation	-0.183	0.144
Holding and Other Investment Company	-0.188	0.168
Manufacturing	-0.144	0.132
Boroughs	0.152	0.157
Ithaca	-0.178	0.205
Business Services	0.131	0.172
Constant	0.102	0.220
Broker	-0.077	0.183
Syracuse	-0.097	0.257
Electrical Equipment	-0.079	0.223
Medium Revenue	-0.032	0.091
Low Revenue	-0.024	0.086
Insurance Agent	-0.055	0.443
High tech	-0.014	0.132
Buffalo	-0.006	0.137
Wholesale Trade	-0.004	0.217

These results indicate that the number of female officers has a significant positive influence on the percentage of female directors within a company. For every additional director on the board, however there is a decrease in the percentage of female board members. If a company is in the real estate industry, it decreases the percentage of female directors on average. Two regions were also significant, Long Island and Albany. A company in either of these regions has a lower percentage of female directors on average.

MODEL 4 - ORDINARY LEAST SQUARES REGRESSION OFFICERS

$$LNPFO=\beta 0+\beta 1(LNNFD)+ \beta 2(LNTNO)+ \beta 3(MR)+ \beta 4(LR)+ \beta 5(A)+ \beta 6(W) +\beta 7(BO)$$
$$+\beta 8(LI)+ \beta 9(I)+ \beta 10(BU)+\beta 11(S)+\beta 12(HI) +\beta 13(BS)+ \beta 14(BR) +\beta 15(TN)+1\beta 6(CA)+ \beta 17(IA) +\beta 18(MA)$$
$$+\beta 19(EE)+ \beta 20(WT)+\beta 21(DI)+\beta 22(RE)+\beta 23(HT) +\beta 24(FI)$$

Where:

LNPFO=LN(Percent Female Officers)
LNNFD=LN(Number of Female Directors)
LNTNO=LN(Total Number of Officers)
MR=Medium Revenue
LR=Low Revenue
A=Albany
W=Westchester
BO=Boroughs
LI=Long Island
I=Ithaca
BU=Buffalo
S=Syracuse
HI=Holding and Other Investment Services

BS=Business Services
BR=Broker
TN=Transportation
CA=Chemical and Allied Services
IA=Insurance Agent
MA=Manufacturing
EE=Electrical Equipment
WT=Wholesale Trade
DI=Depository Institutions
RE=Real Estate
HT=High Tech
FI=Female Industry

Base Variables (For Dummy Variables)

Revenue: High Revenue
Region: Manhattan
Industry: Retail Trade

Ordinary Least Squares Regression Dependent: LN(Percent Female Officers)
Adjusted R-squared: .38
**** denotes highly statistically significant variable * denotes statistically significant variable**

Variable	Coefficient	Standard Error
**Constant	-0.747	0.181
**LN(Total Number of Officers)	-0.524	0.066
**LN(Number of Female Directors)	0.257	0.085
**Holding and Other Investment Company	0.529	0.189
Chemical and Allied Products	-0.308	0.163
Female Industries	0.270	0.156
Manufacturing	0.236	0.150
Medium Revenue	0.153	0.107
High tech	-0.199	0.152
Buffalo	0.193	0.156
Wholesale Trade	0.300	0.249
Low Revenue	-0.117	0.101
Depository Institutions	0.171	0.169
Ithaca	0.224	0.236
Transportation	0.116	0.167
Boroughs	-0.113	0.180
Albany	0.130	0.211
Long Island	-0.038	0.114
Electrical Equipment	0.042	0.257
Broker	0.032	0.212
Real Estate	0.041	0.281
Westchester	-0.014	0.104
Business Services	0.009	0.199
Insurance Agent	-0.014	0.508
Syracuse	0.003	0.297

The results of this analysis show that the number of female directors, the total number of officers and whether a company is in the holding and other investment services industry are all significant predictors of the percentage of female officers of the corporation. On average, as the number of female directors increases, the percentage of female officers also increases. In contrast, an increase in the total number of officers within the corporation, on average, leads to a decrease in the percentage of female officers. Companies classified as holding and other investment services have a higher percentage of female officers. In this case, region was not a significant explanatory variable.

EXPLANATION OF RESULTS

RELATIONSHIP BETWEEN OFFICERS AND DIRECTORS

After completing the regression analysis, it was determined that the presence of female officers is a positive and highly significant predictor of both the presence and percentage of female directors on the boards of directors of New York State corporations. These results suggest that corporations with more female officers tend to have a greater percentage of women on the board of directors than other firms. There are two reasons why this may be the case. Those corporations with a higher percentage of women as officers may be more progressive in the representation of women and may, therefore, be more likely to have women as directors. Also, these corporations have experience with women working in high level positions and knowing that a female officer does not have an adverse effect on the company may be less apprehensive about having a female director than other companies may be.

The analysis also revealed that the number of female directors was also a significant predictor of whether or not a company had at least one female officer. This may be because companies with female directors may have chosen these women from within the company, as many directors are chosen. As a result, the female officers of the company may be the same women as the females on the board of directors. In addition, since directors have some influence over the policies and operations of a corporation, women on corporate boards may advocate the hiring and promotion of women.

INDUSTRY AND FEMALE REPRESENTATION

Surprisingly, there was not a statistically significant relationship between the dummy variable representing high tech industries and the representation of women among officers and directors. Since data indicate that women are represented at a lower percentage than men among managers in high tech industries, these results would suggest that in New York, women might actually be promoted to the positions of officer and director at a higher rate in high tech companies than in low tech companies. The difference in promotional rates would lead to the insignificant difference in the percentage of women in these positions in high and low tech companies. This result contradicts the common perception that women are discriminated against at higher rates in male dominated industries such as high-tech with reference to promotional rates.

Another surprising result was that female industry was not a significant predictor. It would be intuitive that since in the aggregate these companies have women representing the majority of both managers and lower level employees these corporations would be more likely to have women represented at top positions than corporations with a lower level of female representation at all levels. These may indicate that in New York women are promoted at an unequal rate in these corporations. If

Table 6	
Percent Female Managers across all Employees in Northeast	
Major Industry	Percent Female Managers
Agriculture*	45
Mining*	26
Construction	21
Manufacturing Durable	25
Manufacturing Non-Durable	33
Transportation	31
Communications	34
Utilities and Sanitary	38
Wholesale	36
Retail	36
FIRE	47
Business, Auto and Repair Services	33
Personal Services Exc. Private Households	39
Entertainment and Recreation Services	56
Hospitals	76
Medical Services Excluding Hospitals	70
Educational Services	58
Social Services	63
Other Professional Services	41
Public Administration	45

*sample too small for northeast, statistics taken for United States as a whole

Source: 1998 Current Population Survey, March Supplement

women were, in fact, promoted at equal levels in these companies, we would expect that there would be a significant difference in the representation of women among companies with a majority of women employees compared to other companies. Data from the Bureau of Labor Statistics in 1999 show that women represent more than half of the employees in retail industries. The present analysis along with data from the Current Population Survey data indicates that women are not highly represented among managers, officers, and directors. This data would therefore support the occupational segregation argument that women are forced into lower level jobs while men are employed in the top positions. In contrast, in most service industries women represent more than half of the managers according to the Current Population Survey. This would suggest that women in these companies might only have a problem reaching the highest levels within corporations since they are represented in more than half of the lower management positions in these companies. These results suggest a glass ceiling effect in these types of companies, where women are promoted until they reach a certain level and then find it nearly impossible to advance further.

Industries that did prove to be significant determinants of the representation of women on the board and among officers were holding and other investment services and real estate. In no case was industry a significant predictor of whether or not there was at least one woman on the board of directors or among officers.

Companies in the holding and other investment industry have a significantly higher percentage of female officers than companies in other industries. However, the holding and other investment industry is not a significant predictor of whether or not there is a woman on the board of directors or the percentage of female directors. The results for female directors and officers seem contradictory. Overall the variable representing the number of female officers in a company has proven to be a significant predictor of whether or not there is at least one woman on the board of directors and the percentage of female directors, but in this case being in the holding and other investment industry predicts only percentage of officers and not percentage or the existence of female directors. One explanation is that director is a position only achieved by few officers within a company. If women have only relatively recently reached the top positions within these companies, they may have achieved representation among officers, but have not yet been able to achieve representation among directors. A time-series analysis with data both before and after 1999 would help settle this issue.

The real estate industry is the only significant predictor of the percentage of female directors. A company in the real estate industry has a lower percentage of female directors, on average. The relationship could be explained by the fact that in these industries there are a greater percentage of men among managers. In the real estate industry; however, there are more women than men at lower levels, this may indicate that women are not promoted at the same rate as men to top positions within these companies.

RELATIONSHIP BETWEEN FIRM SIZE AND FEMALE OFFICERS AND DIRECTORS

In this study, two measures of size were used. The first measure is revenues. Revenues are used as a proxy for the overall size of the firm since other data such as the number of employees were not available for most companies. On the whole, in reference to both whether or not there is a woman on the board of directors and among officers, companies with medium revenues are less likely to have female representation than high revenue companies. This would indicate that larger companies are more likely to have female representation on the board of directors than smaller companies. It is interesting to note, however, that low revenues are not a significant predictor. This would indicate that companies with low revenues are not significantly different from those with larger revenues. The surprising result, therefore, appears to be that both very small and very large companies are more likely to have female representation in top positions than mid-size corporations. There is no relationship, however, between revenues and the percentage of female directors or the percentage of female officers in a company.

Therefore, it appears that the size of the company influences whether or not there is female representation, but not the degree of this representation.

It was expected that larger corporations would tend to have more women represented in these positions than smaller corporations. Larger companies may face increased pressure to have some female representation on the board of directors and among officers, since their size makes them better known. They may, therefore, be more likely to have at least one woman on the board and among officers as a token, to show that they are not against having female representation and are not discriminatory. This would also explain why in general revenue is not a significant predictor in the percentage of female representation. Even though there is at least one woman on the board and among officers, the overall influence of women within the company is not great. An explanation for the insignificant difference between low and high revenue firms with respect to female representation may be that small firms are more likely to be small family owned businesses and therefore the entire family, including the women, may be involved in the company. Smaller corporations may also have better records or better access to data on individual employee performance because there are fewer employees to keep track of. As a result, women may be evaluated in a more objective manner when up for promotion. Companies with low revenues may also be more likely to have been founded recently since in general they are smaller companies. Therefore, they may have been established in an era when women are treated more equally than they were in the past when some of the large corporations were founded. In recently founded companies, women may have held high positions since its inception because of the social atmosphere, as a result these women did not have to work their way up through the company facing unequal opportunities that they may have encountered in older companies.

The second measure of the size is the total number of directors and officers for each corporation. In the logistic regression, the results indicate that as the number of directors and the number of officers increase, the odds of having at least one female director or officer increase. This indicates that women are more likely to be represented in companies with larger boards and a large number of officers than they are in other companies.

There are several possible explanations. Assuming the rates of promotion are the same for women in both large and small firms, the larger firm is likely to have a greater number of women in top management positions from which to choose a candidate for the board of directors. As a result of this larger pool, it is easier to have a greater range of personal characteristics, which could increase the chance that there is at least one woman that the company believes would fit the tastes and preferences of the voters and therefore could be on a slate that would be approved by the shareholders. However, as the size of the board increases, each director has less impact on the policy decisions of the corporation. Therefore, having a token on a larger board is less threatening than on a smaller board where a woman could have more influence on the outcome of a vote. The same can be said with respect to officers; with a large number of officers, the impact that each individual can have on the operations of the corporation is not as great as it would be with fewer officers. Therefore, it is easier to have a woman represented among officers as a token since her impact has been minimized by the large group of officers.

In the results from the ordinary least squares regression that looks at the sample of companies with at least one female officer/director, we see the opposite relationship. As the number of total officers and directors increases, the percentage of women decreases. Since the companies that do not have any women have been eliminated, this result is not surprising. As the number of officers and directors increases, the percentage of the total that each individual represents is lower. As a result, a large board with one woman would have a lower percentage of female directors than a small board that has one woman. The results suggest that companies with larger numbers of officers and directors, while more likely to have at least one woman represented, actually have women playing less of a role than those companies with lower numbers of officers and directors, since each individual has less influence among a larger group.

RELATIONSHIP BETWEEN REGION AND FEMALE REPRESENTATION

The results of this analysis suggest no region is a significant predictor of whether or not a company has a female director or the percentage of female officers. In the case of whether or not a company has at least one female officer, Albany and Westchester both have increased odds of female representation. Long Island and Albany are significant predictors in relation to the percentage of female directors, both having a lower percentage of women on average. It is interesting to note that Albany has the opposite effect on the representation of women among officers and directors. It is unclear why some regions are significant predictors of the odds and percentage of female representation while others are not. Further analysis looking into the influence of the community and residents of the region, the qualifications of the women in the region for top-level jobs, and the types of educational opportunities that exist for women in the region needs to be undertaken to understand these differences. It could be that some regions have more qualified women in their hiring pool than others or that in some regions there is more pressure from the community to have female representation in top corporations, but none of these conclusions can be drawn from the data available in the present analysis.

LIMITATIONS OF RESEARCH

Some limitations of this data are that information about the total number of employees and the number of employees by gender was unavailable for these corporations. As a result, revenues were used as a proxy for the size of the corporation. Usually larger corporations have higher revenues than smaller corporations and therefore revenue was the best available measure of size, although a more accurate analysis could be performed with a better measure of the size of the companies. If we had data regarding the number of employees by gender, we would have been able to better pinpoint at what level within the corporation the representation of women becomes disproportionate. Being able to pinpoint this level would help us to better understand occupational segregation and the glass ceiling effect in New York State based corporations. Another shortfall is that data were not available on the education, experience, and tenure of the employees in these corporations. As a result, we could not control for these variables in the analysis. It is possible that there may be differences in these characteristics by region, industry, or firm size, which may explain some of the significant differences with respect to the representation of women in top offices.

There are also some limitations of the statistical analysis used in this research. These regression analyses assume independence among the explanatory variables. Although interaction terms were used (and found to be insignificant) to help test this assumption, it has not been entirely met. With respect to regions, for example, neighboring regions are most likely related in some way in that an event in one region will have an impact on an adjacent region. This may also be true among related industries. Finally, there is the assumption of constant variance. The models were also checked to see if they met this assumption and constant variance was closely but not perfectly approximated with the data. All of these slight departures from the assumptions of regression analysis can limit the effectiveness of this analysis in interpreting and analyzing the data. In addition, departures from assumptions mean that the results and their implications cannot be generalized.

CONCLUSION

One explanation for the absence of women in top corporate positions is the presence of discrimination. Sometimes business decisions affecting women are based on the perception that each woman is the statistical “average woman”, or the “stereotypical woman” rather than an individual. This “average” or “stereotypical” woman is portrayed as being less committed to the company, willing to work fewer hours because of family responsibility and more discontinuous in her labor force participation than men. Even women who do not fit this profile may be judged based on these perceptions. Since the “average female” is not a desirable candidate for election to the board of directors, it is possible that qualified female candidates are overlooked as a result of the stereotypical way in which corporations may view women. Although the characteristics of the “average woman” are unfavorable for the board of directors, this average does not reflect the characteristics of all women in the workforce and the differences in male and female patterns of labor force participation are diminishing. For example, the gaps between male and female commitment to the labor force, loyalty to employer, and number of hours worked have decreased over the last forty years.[4] Contributing to this trend is the decrease in fertility rates over the last thirty years and the increased assistance from men with family responsibilities.[5] This increases the ability of women to devote more time to their careers.

A potential determinant of the lack of female officers is that women may be less likely than men to be promoted from lower positions within the company as has been documented in a number of studies mentioned earlier.[6] There are several theories that explain the factors that may contribute to men being promoted more than women within a corporation. One explanation is that women have fewer opportunities for on–the-job training than men. Another possible factor is that women have a greater proclivity to leave the workforce to raise children or care for their family than men and may, therefore, have increased discontinuity in their labor force participation. A third theory which attempts to explain the absence of women in the highest positions within corporations is occupational segregation, wherein women are crowded into female dominated occupations that often provide fewer advancement opportunities than male-dominated occupations.

In order for women to be represented equally on corporate boards, they must first be represented equally among officers and other managerial occupations within companies. The low percentage of women on the board of directors is a reflection of the low number of women in the highest positions within this population of companies.

This paper explores the issue of female representation with respect to officers and directors in the population of publicly traded companies based in New York State. As opposed to prior research that has focused on a single industry or corporation or an elite group of corporations this paper adds to the literature on the representation or discrimination of women in the workplace by being unique in that it explores the representation of women across corporations with a wide ranges of industries, revenues and size. It is important to take all of these considerations into account when exploring the under-representation of women so that we can better pinpoint the corporate characteristics that may influence the representation of women. By understanding the exact types of corporations where women are underrepresented in influential positions we may be better able to determine whether women are underrepresented due to the lack of qualified candidates, influence of industry norms or labor unions, discrimination, etc. Once we understand why women are underrepresented we can focus on how to ameliorate the problem. Some possibilities are targeting women in promoting available positions within these types of corporations attempting to recruit women into educational and training programs that would help them attain the qualifications needed to be employed in top positions, influencing public policy to provide incentives to corporations to hire or train women, and providing incentives to women to encourage them to pursue careers in these types of corporations.

It appears that in 1999, women are still under-represented in the highest positions in business. Only 11.6 percent of corporate officers and a mere 6.3 percent of directors in this sample are female. However, the analysis suggests that in New York, women may be promoted at higher rates than men in some male dominated industries such as high tech industries because there is no difference in the representation of women in high tech corporations compared to low tech corporations. Since women are represented in lower percentages at all levels in high tech corporations, if they were promoted at an equal rate as low-tech companies we would expect that they would have a lower representation of women among officers and directors reflective of their lower representation at all levels in these corporations. Surprisingly, the results suggest that there is no significant difference between the representations of women in top corporate positions depending on whether the corporation is in a female dominated industry. On the whole, region and industry do not seem to play a large role in the representation of women. Finally, the research suggests that there are positive relationships between the representation of female officers and female directors between percent female officers and directors. This would indicate that, overall, the representation of women at lower positions within a firm influences their representation at higher levels.

ENDNOTES

1. See Blau (1998); Reynolds (1998).
2. See Blau (1998); Rix(1990), Cook (1990)
3. Odds ratio for variable in logistic regression equals $e^{\text{coefficient of the variable}}$
4. See Blau (1998); McGratten (1998).
5. See Blau (1998); Reynolds (1998).
6. See Cabral (1981); Becker (1983); Spurr (1990); Winter-Ember (1991); Cannings (1991); Shore (1992).

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A DUOPOLY MODEL OF FIXED COST CHOICE

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1. INTRODUCTION

Comparison of firms in Cournot and Stackelberg equilibrium is a subject that has received much attention. A universally imposed assumption in most discussions of the Cournot and Stackelberg outcomes is that participants in markets are confronted with given cost structures. In some setups, like the models of Robson (1990), Anderson and Engers (1992) and Shaffer (1995), firms are assumed to have identical costs. In others, such as the Stackelberg model developed by Pal and Sarkar (2001) firms have different costs. However, the sequence of costs of firms choosing output is fixed, as is the level of costs once the equilibrium is obtained.

This assumption is, of course unrealistic, since firms invest considerable time and effort in cost cutting to either increase profit or market share. The purpose of the present paper is to study the impact of cost changes on firms in Cournot and Stackelberg equilibrium. We do this using a model similar that that of Neuman, Weigand, Gross, and Muenter (2001). The model assumes that firms can reduce marginal costs by investing in assets, thereby increasing fixed costs.

In Section 2 we set up the initial revenue and cost conditions facing the firms. For ease of exposition, a duopoly with linear market demand and cost functions is employed. In this section we present standard results for the Cournot and Stackelberg duopoly models.

In Section 3, we introduce the assumptions about the cost-changing possibilities for the firms and determine optimal fixed costs. We evaluate the impact of setting fixed costs at their optimal levels on profit and market share for the firms in the two models. Section 4 provides empirical evidence on the relationship between fixed and variable costs chosen by firms. Section 5 contains some brief concluding remarks.

2. A SIMPLE MODEL OF COURNOT AND STACKELBERG EQUILIBRIUM

Consider a situation with linear market demand produced by two firms. The inverse demand function will be given by $P = A – BQ = A – B(q_1 + q_2)$, where P is price, Q is quantity, and parameters A and B are both positive. Output is produced under two market settings.

First, we consider a Cournot model. For this model total costs for the ith firm, where i = 1,2, will be of the form $TC_i = FC_i + C_i q_i$, where FC is fixed cost and C is marginal cost. Costs are identical for the Stackelberg model. However, for ease of exposition the subscript i is replaced by

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L for the Stackelberg leader and F for the follower firm.

In the Cournot model profits for firm i are given by

$$Profits_i = (A - C_i)q_i - Bq_i^2 - Bq_iq_j - FC_i. \qquad (1)$$

Maximizing profits for the two firms and simultaneously solving the reaction functions results in the outputs:

$$q_1 = \frac{A - C_1 + C_2 - C_1}{3B}, \quad q_2 = \frac{A - C_2 + C_1 - C_2}{3B}. \qquad (2)$$

The resulting market shares are

$$M_1 = \frac{A - C_1 + C_2 - C_1}{A - C_1 + A - C_2}, \qquad M_2 = \frac{A - C_2 + C_1 - C_2.}{A - C_1 + A - C_2}. \qquad (3)$$

Profits for the two firms are

$$Profits_1 = \frac{1}{9B}\left[A - C_1 + C_2 - C_1\right]^2 - FC_1,\ Profit_2 = \frac{1}{9B}\left[A - C_2 + C_1 - C_2\right]^2 - FC_2. \ (4)$$

Equations (3) and (4) show the familiar results for a duopoly in Cournot equilibrium. Market shares and profits are proportional to firm costs, with the larger market share and higher profits going to the lower marginal cost firm.

For the Stackelberg model begin with the profits for the leader and follower firm:

$$Profits_L = (A - C_L)q_L - Bq_L^2 - Bq_Lq_F - FC_L, \qquad (5)$$
$$Profits_F = (A - C_F)q_F - Bq_F^2 - Bq_Lq_F - FC_F.$$

The follower's reaction function is derived from its first-order condition:

$$q_F = \frac{1}{2}\left[\frac{A - C_F}{B} - q_L\right]. \qquad (6)$$

Substituting (6) into the leader firm's profits and maximizing with respect to q_L yields the outputs for the Stackelberg model

$$q_L = \frac{A - C_L + C_F - C_L}{2B},\ q_F = \frac{A - C_F + 2(C_L - C_F)}{4B}. \qquad (7)$$

Market shares for the Stackelberg firms are therefore

$$MS_F = \frac{A - C_F + 2(C_L - C_F)}{2(A - C_L) + (A - C_F)}, \quad MS_L = \frac{2(A - C_L) + 2(C_F - C_L)}{2(A - C_L) + (A - C_F)}. \qquad (8)$$

Profits for the Stackelberg firms are

$$Profits_F = \frac{1}{16B}\left[A - C_F + 2(C_L - C_F)\right]^2 - FC_F, \qquad (9)$$

$$Profits_L = \frac{1}{8B}\left[A - C_L + C_F - C_L\right]^2 - FC_L.$$

Equations (8) and (9) are similar to (3) and (4). They show that, similar to the Cournot model, in Stackelberg equilibrium a firm's market share and profits will increase when its marginal costs are lower than its rival's. However, in the market share equations a larger weight is placed on the margin of price over marginal cost for the leader firm, measured by the differential ($A – C_L$).

3. **CHOICE OF FIXED COST AND BEHAVIOR OF THE FIRM**

Our model of cost setting is constructed using a model similar to the one provided by Neumann et al. (2001). These authors suggest that if higher fixed costs are a result of new and improved production techniques, such costs may result in lower marginal costs. We therefore assume a relationship between fixed and marginal costs of the form

$$C = K_0 - K_1 * FC, \qquad K_0, K_1 > 0. \qquad (10)$$

The parameter K_0 defines the level of marginal costs without the cost-reducing investment FC, while K_1 is the decrease in marginal costs per dollar investment in fixed costs. Since marginal costs must be positive, equation (10) is relevant over the range of fixed costs $0 < FC < K_0/K_1$. Also note that the restriction $A > K_0$ must hold. This is equivalent to assuming that the equilibrium price must be greater than the marginal cost consistent with zero fixed costs. The assumption assures that price covers marginal costs under all possible situations.

All firms will be assumed to have access to the above technology, and will choose the profit-maximizing level of fixed costs using equation (10). This choice can be thought of as the second stage in a two-stage game, where the first stage is the choice of a profit-maximizing level of output. Although the Stackelberg model assumes a first-mover advantage for the leader firm in setting output, firms in both models will engage in simultaneous play at the second stage. This means that each firm will choose its profit-maximizing level of fixed costs given its rival's choice. The outcome of the second stage will be a *Nash equilibrium* in the choice of fixed costs.

Substituting (10) into (4) and (9) and differentiating with respect to FC results in the firm's profit-maximizing level of fixed costs. Substituting these costs into (3), (4), (8), and (9) yields the market shares and profits assuming the optimal levels of fixed costs are obtained. All results are displayed in Table 1[1].

Table 1: The Impact of Optimal Fixed Cost Choice by Type of Firm			
Firm Type	Optimal Fixed Cost	Resulting Market Share	Resulting Profit
Cournot	$\frac{K_0 - A}{K_1} + \frac{9B}{4K_1^2}$	$\frac{1}{2}$	$\frac{A - K_0}{K_1} - \frac{27B}{16K_1^2}$
Stackelberg Leader	$\frac{K_0 - A}{K_1} + \frac{13B}{6K_1^2}$	$\frac{3}{5}$	$\frac{A - K_0}{K_1} - \frac{5B}{3K_1^2}$
Stackelberg Follower	$\frac{K_0 - A}{K_1} + \frac{7B}{3K_1^2}$	$\frac{2}{5}$	$\frac{A - K_0}{K_1} - \frac{17B}{9K_1^2}$

The optimal fixed costs for the three firms contain the common factors $(K_0 – A)/K_1$ and B/K_1^2. Since 7/3 > 9/4 > 13/6, optimal fixed costs are highest for the Stackelberg follower and lowest for the Stackelberg leader, with fixed costs for the Cournot firm falling between these two extremes. This result is intuitively appealing. It suggests that since investment in capital expenditures reduces marginal costs with the potential of increasing profit margins, the incentive to do so is greatest for the firm in the most disadvantageous market position. A similar link between firm capitalization and firm positioning has been noted by Porter (1980, Chapter 15).

This choice in fixed cost results in equal market share for the two firms in Cournot equilibrium. This result is the same as the market shares obtained from equation (3) assuming $C_1 = C_2$, which is the standard result for a Cournot duopoly with equal marginal costs for the two firms and no choice of fixed costs. The result is a direct consequence of the firms having access to the same marginal cost reducing technology, and is the expected outcome of the simultaneous play at the second stage of the game. It suggests that no matter what the initial marginal costs, simultaneous play and access to the same marginal cost reducing technology at the second stage of the game will always allow the firm in a disadvantageous market position to “catch up” in market share[3]. This finding supports the apparent willingness for some firms to compete for market share as well as profits, since higher market share may be a more easily attainable goal than higher profits.

In the Stackelberg model the resulting market shares are 3/5 going to the leader and 2/5 of the market output going to the follower. This can be compared to the market shares for the Stackelberg model with equal initial marginal costs and no marginal cost reducing choice of fixed costs[4]. In this alternative situation the leader's market share will be 2/3 of the market, with the follower's share being 1/3. Since 2/5 > 1/3, in terms of market share the Stackelberg follower firm prefers the situation in which it can reduce marginal cost by investing in fixed costs to the situation in which its marginal costs are the same as the leader firm's. However, any potential market share disadvantage cannot be completely made up by choice of fixed cost as in the Cournot model. In essence, some of the first-mover advantage of the Stackelberg leader in choosing output remains with the leader in the second stage of the game.

Profits assuming fixed costs are at the optimal level are similar to fixed costs, both having the common factors $(A - K_0)/K_1$ and B/K_1^2. However, since 5/3 < 27/16 < 17/9, the ordering of profits is opposite that of fixed costs. Profits for the Stackelberg leader are largest. Profits for the Stackelberg follower are smallest. The Cournot profits lie between these two values.

The results for profits in the Stackelberg equilibrium are like those comparing market share. They show that the reduced profits resulting from moving second in a Stackelberg game cannot be eliminated by investing in fixed assets once equilibrium is obtained. The result is in the spirit of observations made by Porter (1980, Chapter 15), who argues that in attempting to catch up with market leaders follower firms have a tendency to over capitalize, thereby decreasing profits.

4. EMPIRICAL EVIDENCE OF COST CHOICE BY FIRMS

The key assumption of the above analysis is equation (10) which postulates a negative relationship between fixed costs and marginal cost. We tested this relationship as follows.

Data on 273 mid-capitalization firms were collected for the period 2002-2000 from the Compustat Data tapes. Accounting costs for these firms were categorized into fixed and variable costs. The variable cost (C) proxy used was Cost of Goods Sold. These costs included labor, heat, power, freight, and other costs directly involved with producing and distributing a product. Some administrative costs such as plant insurance were also reported under this heading. The fixed cost (FC) measure included non tangible fixed costs such as advertising and marketing costs, as well as fixed costs associated with tangible property. Examples of such costs would be tools and dies, software, and aircraft. Fixed costs were measured relative to total assets to avoid the impact of firm size on cost measurement.

Two functional forms were estimated.

$$\Delta C_t = \alpha + \beta_1 \Delta(\frac{FC}{A})_{t-1} + \beta_2 \Delta(\frac{FC}{A})_{t-2} + \beta_3 \Delta(\frac{FC}{A})_{t-3} \qquad (11a)$$

$$C_t \setminus C_{t-1} = \alpha + \beta_1 \Delta(\frac{FC}{A})_{t-1} + \beta_2 \Delta(\frac{FC}{A})_{t-2} + \beta_3 \Delta(\frac{FC}{A})_{t-3}. \qquad (11b)$$

Equation (11a) assumes a linear relationship between the current change in variable costs and lagged changes in fixed costs. The lags are included to allow for adjustment time. Equation (11b) expresses the change in variable cost in the form of the ratio of current variable cost to the previous period's variable cost. If equation (10) is a reasonable assumption, we should find significant negative values for the β_i in (11).

Table 2 displays these estimated coefficients. The t-statistics are in parentheses. The results are consistent with equation (10). The table shows a significant negative relationship between fixed and variable costs at the one period lag for the years 2002 and 2000, and a mild negative relationship at the three period lag for 2001. For 2002 the one period lag coefficient was significant when the dependent variable was expressed in both change and ratio form, while only the ratio form was significant for 2000.

When estimated over the entire 2002-2000 time period, a significant negative relationship between changes in fixed and variable cost was displayed at the one period lag. This relationship held when changes in variable costs were measured in both absolute and relative terms.

Table 2: Changes in Variable Costs Regressed Against Fixed Cost

Independent Variable	2002		2001		2000		2002 - 2000	
	ΔC_t	Ct/Ct-1	ΔC_t	Ct/Ct-1	ΔC_t	Ct/Ct-1	ΔC_t	Ct/Ct-1
$\Delta(FC/A)_{t-1}$	-1728.6***	-0.59****	128.9	-0.28	-70.3	-0.78***	-664.8**	-0.61****
	(-2.364)	(-3.138)	(+0.308)	(-0.979)	(-0.147)	(-2.408)	(-2.009)	(-3.839)
$\Delta(FC/A)_{t-2}$	273.1	0.47**	119.8	0.01	389.8	-0.07	288.9	0.20
	(+0.316)	(+2.114)	(+0.295)	(+0.021)	(-0.882)	(-0.224)	(+0.874)	(+1.235)
$\Delta(FC/A)_{t-3}$	-93.6	0.004	-163.6	-0.444*	-148.0	-0.42	NA	-0.26*
	(-.115)	(+0.023)	(-0.446)	(-1.8)	(-0.391)	(-1.624)		(-1.829)
R-squared	0.0219	0.0581	0.0018	0.0153	0.0047	0.0276	0.0069	0.0266

*Significant at the 10% level
**Significant at 5% level
***Significant at 2% level
****Significant at 1% level

In sum, increases in fixed costs enable firms to decrease variable costs. And, this relationship seems to occur rather rapidly, that is, within one to two years.

5. CONCLUSIONS

Most comparisons of firms in Cournot and Stackelberg equilibrium assume given cost structures. The current paper analyzes the impact of marginal cost reducing fixed investment on market share and profits of firms in Cournot and Stackelberg equilibrium. The setup can be conceptualized as a two-stage game. At the first stage firms choose their profit-maximizing output. Cournot and Stackelberg duopoly models were used at this stage. In the second stage, firms were given the option of reducing marginal costs by investing in fixed costs. For both models, firms engaged in simultaneous play at this stage.

We found the greatest investment in fixed cost was for the Stackelberg follower and the smallest for the Stackelberg leader. The Cournot firm's investment fell between the two extremes. Resulting profits mirrored these investments, with the smallest accruing to the Stackelberg follower and largest to the Stackelberg leader.

Perhaps the most interesting result was the difference in market shares resulting from the two models. In the Cournot model, if a firm started from a smaller market share due to higher marginal costs, its investment in fixed costs at the second stage allowed it to equalize its market share relative to the lower-cost firm. This was not true in the Stackelberg model. No amount of fixed investment allowed the follower to equalize its market share with the leader's market share. The same held true for profits. This suggested that the first-mover advantage of the Stackelberg model was carried by the leader into the second stage of the game.

These conclusions assume that firms can reduce marginal costs by investing in fixed assets. Empirical evidence supporting this assumption was provided.

ENDNOTES

1. Proofs of these results are available from the author upon request.
2. The set of feasible solutions requires that fixed costs are greater than zero. These parameter restrictions are also available from the author on request.
3. We are not certain the extent to which this conclusion is dependent on our use of a linear function linking fixed and marginal costs.
4. Assume $C_L = C_F$ in equation (8).

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PUBLIC DISCLOSURE AND BROKERAGE SEARCH

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Subjecting corporations to a higher standard of financial disclosure affects the welfare of public investors in several ways. By examining the interaction between a large public investor and dealers, we show that disclosure affects the equilibrium transaction price in two ways: (1) Disclosure increases the precision of all market participants' signals regarding the value of the risky asset and increases the equilibrium price; (2) Disclosure reduces the adverse-selection risk counter-party traders associate with a large size trade and reduces the equilibrium price. The net, overall effect of trade disclosure depends on the interaction of these two effects. Further, we show that in order for a rational expectations equilibrium to exist, the quality of firm-specific information resulting from disclosure has to be modest relative the perceived need for non-information trading.

1. INTRODUCTION

Recent concerns about the adequacy of corporations' public disclosure of financial information and the behavior of corporations with respect to those disclosures have renewed interest in new regulations that would reduce the information asymmetry between insiders and investors. Considerable attention has been focused on whether present accounting standards mandate sufficient revelation on the financial well-being of firms[1]. Currently, there are a number of proposals before Congress that seek to raise the level of accounting standards governing public disclosure of financial information and increase the level of transparency with regard to the true value of public corporations. The recently enacted Sarbanes-Oxley Act of 2002 is but one example.

This paper presents a simple model to examine the interaction between a large investor (e.g. a manager of a mutual fund or pension fund) and dealers in the context of a price search process. In particular, we look at the impact of greater market transparency resulting from a higher standard of disclosure of publicly held firms. A key factor underlying our results is that the impact of public disclosure on the welfare of the investor results in an interaction between public information and risk sharing. While the objective of this paper is to provide a theoretical analysis of the impact of disclosure on public welfare, which is important in its own right, our results also have testable empirical implications.

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One aspect of financial markets that has received little attention in studies on the issue of market transparency is its effect on the search behavior of large investors in connection with a brokerage service. In reality, the search for optimal prices and information by liquidity traders before executing a large trade is a fact of life. Over the last several decades, the participation of institutions, especially mutual funds and pension funds in securities markets has been increasing. The participation of financial institutions is evidenced by the substantial fraction of block trades in the market.[2] Relatively small portfolio adjustments by large financial institutions are often too large for a specialist to absorb. These large blocks of trade are often brought to the “upstairs market” maintained by large broker-dealer firms. These “blocks” are then “chopped” and searches are initiated for counter-parties. These trades are reported to the relevant specialists on the floor, i.e. “downstairs market”, after counter-parties are located and deals struck. A number of authors have studied the price effect associated with block trades. Burdett and O’Hara (1987) analyzed the economic role and behavior of a block trader in a Bayesian sequential decision framework and demonstrate that the trading process may generate information effects on security prices. Grossman (1992) developed a model of upstairs versus downstairs markets and showed that equilibrium liquidity in both markets is characterized by the trade-off between the benefits of information about unexpressed demand and the cost to the customer of trading in a fragmented market. Using transaction data from upstairs trades, Keim and Madhavan (1996) find that price movements prior to the trade date are significantly and positively related to trade size, consistent with information leakage as the block is “chopped” upstairs. Recently, Wu and Zhang (2002) examined the effect of disclosure of securities market performance when liquidity traders are able to acquire information through learning. They found that liquidity traders do not necessary benefit from increased transparency. Zhang et al. (2004) examine the interaction of brokerage search with the Bayesian learning behavior of competitive dealers under asymmetric information. They show that both spread revision and price volatility are dependent upon the optimal search process, inventory fluctuation, and search cost. Most recently, Zhang (2004) has examined the interaction of risk aversion and disclosure and shows that, under a disclosure requirement, an insider would camouflage his trades with a noise component so that his private information is revealed slowly and linearly. The common theme of these works suggests that a large order is believed to contain more information and there is a positive relation between trade size and price impact. The impact of public disclosure on a liquidity trader’s search strategy and the brokerage-search process, however, has not been considered.

In this paper, we extend the analysis of previous studies on large trades by developing a simple model in the rational expectation frameworks of Kyle (1985) and Grossman (1992). We examine the brokerage search process within the context of a large trade by an investor and effect of information from public disclosure on his welfare. Our article differs from previous articles on block trading in two critical ways. First, the trade initiator in our model is an uninformed liquidity trader who, through the services of a broker, obtains a signal regarding the value of a risky asset and contacts an optimal number of counter-party traders. The precision of this liquidity trader’s signal depends on the availability of specific information about the risky security in the market resulting from public disclosure. In practice, such disclosure would take the form of outside auditing of a firm’s financial information. Second, the welfare of the large investor is examined with respect to disclosure and its interaction with the brokerage search process. In particular, we examine the impact of public disclosure on different aspects of the equilibrium price of the risky asset. Our result suggests that disclosure affects the equilibrium price in two ways: (1) Public disclosure increases the precision of all market participants' signals regarding the value of the risky asset and increases the equilibrium price; (2) Public disclosure reduces the adverse-selection risk counter-party traders associate with a large trade and reduces the equilibrium price. The net, overall effect of trade disclosure depends on the interaction of these two effects.

The remainder of article is organized as follows. Section 2 presents the general framework of the model. Section 3 discusses the trading sequence and trading strategies of each type of trading agent. Section 4 derives the equilibrium price and the condition under which such an equilibrium exists. Section 5 examines the effect of public disclosure on the welfare of the large investor and discusses the empirical implications of our results. Section 6 summarizes the article.

2. THE BASIC FRAMEWORK

We consider an economy in which a risky asset (e.g. the stocks of a firm), whose value is uncertain, is traded. There are three types of agents in this model: a larger investor (e.g. the manager of a mutual fund and a pension fund) who initiates a large trade for portfolio hedging and/or other non-information reasons (i.e. a liquidity trader), a broker who facilitates the trade, and dealers who take the other side of the trade. Each agent maximizes his utility given his conjecture regarding the strategic behavior of other agents and his information about the true value of the risky security. We consider a dealership market where there are many identical dealers with homogeneous expectations dealing in the risky security. We assume that the risky security has a post trade full-information value of $\tilde{v}$ and a prior distribution that is normally distributed with a normalized mean zero[3] and a variance σ_v^2. Uncertainty can be represented by a random variable of any variety, but the normal distribution is well-behaved mathematically and understood at an intuitive level by most researchers. Dealers are risk averse with negative exponential utility and possess zero starting-inventory. The negative exponential utility function has desirable qualities for a utility function: it is increasing and concave in the consumable good (the risky asset), implying that dealers prefer more to less, but to a decreasing degree. The true appeal of the negative exponential utility function, however, is that when it is used in conjunction with the normal distribution, it results in a tractable analysis. Both the normal distribution and the negative exponential utility are standard in the paradigms of Kyle (1985) and Grossman (1992). We define the trade order as the liquidity trader wishing to buy Q shares of the risky asset, which is to be determined endogenously. Before executing the order, the liquidity trader would utilize the service of a broker. The service of the broker is needed for two reasons: (1) The liquidity trader would like the broker to locate an optimal number of dealers to share the order of Q shares in order to minimize the size impact; and (2) to search for information regarding the true value of the security in the process.

3. TRADING SEQUENCE

Our analysis examines the trading sequence in a reverse order. First, we consider the dealers who would take the opposite side of the trade. Second, we examine the process of brokerage search--the cost of search, the information signal obtained from the search, and how the number of counter-party dealers is chosen. Then, we analyze the strategy of the large investor, the endogenously determined order size Q, and the transaction price in a rational expectation equilibrium. Finally, we examine the impact of public disclosure on the welfare of the liquidity trader.

3.1 COUNTER-PARTY DEALERS

The size of the purchase order initiated by the liquidity trader, *Q*, is chosen endogenously by considering the supply from counter party dealers who, as noted earlier, are risk averse with negative exponential utility functions. Their optimization problem is one of mean-variance utility maximization given the post trade wealth constraint. That is, the ith representative dealer attempts to

$$\max_{q_i} \quad E[\tilde{W}_i] - \frac{\rho}{2} Var[\tilde{W}_i], \qquad (1)$$

where $E[\bullet]$ and $Var[\bullet]$ represent the mean and variance operator, $\tilde{W}_i$ is the random post trade wealth and ρ is the coefficient of absolute risk aversion. The post trade wealth is given by

$$\tilde{W}_i = (\tilde{v} - p)q_i + z_i \qquad (2)$$

where $\tilde{v}$ is the full-information value of the risky asset, *p* the transaction price, *q* the number of shares of the risky security supplied by the ith dealer, and z_i is the ith dealer's cash holding. We assume counter-party dealers know the total size of the order. This assumption is motivated by a reputation consideration on the part of the broker who wishes to maintain long-term relationships with potential customers and business associates. Substituting Equation (2) into Equation (1) and maximizing utility with respect to q_i, we can derive the supply function from the representative dealer q_i. This yields

$$q_i(p,Q) = \frac{E\left\langle \tilde{v} \middle| Q \right\rangle - p}{\rho Var\left\langle \tilde{v} \middle| Q \right\rangle} \qquad (3)$$

The supply function depends on the total size of the order because the dealer's belief about the true value of the risky security, as will be seen later, depends on a noisy signal inferred from *Q*, the total trade size.

3.2 THE BROKER'S SEARCH

We assume the broker is a competitive agent who does not hold inventory but facilitates the optimal and efficient execution of a large trade by searching for information as well as for counter-party dealers[4]. The broker is competitive in the sense that he would expect zero profit from the order execution and only charges a commission based on his search effort. This is reasonable given that large investors such as financial institutions have much greater market power and are valuable customers a broker would like to keep. Further, potential competition from other brokers will tend to let large investors capture all the rent. In the course of search, the broker faces a number of problems. From the point of view of minimizing the impact of a large trade order on transaction price and obtaining information, he would like to contact as many dealers as possible. On the other hand, the cost of search will increase as the number of dealers contacted increases. Search costs will include the physical cost of making contact with dealers, which will be relatively small. More significant search costs are information cost and reputation cost. The cost associated with revealing a larger impending trade to an increasingly large group of people as more dealers are contacted is one type of information cost. The cost to the broker from failing to arrange the trade in a timely manner is related to both information costs and reputation costs. Reputation cost, in particular, may arise even if counter-party dealers realize that the broker and his client, the large investor, are manifestly uninformed. Dealers to whom a trade subsequently results in losses may be reluctant to participate in future trades arranged by the broker. Thus it is reasonable to model search cost as an increasing function of the number of dealers contacted. The cost associated with the search process will depend on the level of information flow in the market. With an increasing level of public disclosure by the firm, for example, information is easier to come by and thus the information cost will be reduced. Furthermore, with public disclosure of more information, reputation cost to the broker is reduced because county-party dealers are less reluctant to participate, which will also reduce the cost of failing to arrange a trade in a timely manner. It is therefore reasonable to assume the search cost will be inversely related to the level of information flow in the market. For our model, we consider a cost function of the form $C(n) = \frac{\lambda n^2}{f}$, where *n* is the number of counter party dealers who would take the opposite side of the trade. The constant λ is inversely related to the probability of locating willing counter party dealers. The marginal cost is increasing implying diminishing returns to search. The parameter *f* is related to the level of public information on the value of the firm.

Suppose *n* counter party dealers are contacted to take the opposite side of the trade, the equilibrium price that clears the market can be obtained by solving the following equation:

$$Q + \sum_{i=1}^{n} q_i(p, Q) = 0 \tag{4}$$

Substituting equation (3) into equation (4), we can express the equilibrium transaction price as a function of the total trade size, *Q* and the number of counter party dealers, *n*:

$$p(Q,n) = E\left\langle \tilde{\nu} \middle| Q \right\rangle + \rho Var\left\langle \tilde{\nu} \middle| Q \right\rangle \frac{Q}{n} = E\left\langle \tilde{\nu} \middle| Q \right\rangle + \frac{\phi Q}{n} \tag{5}$$

where $\phi = \rho Var\langle \nu \mid Q \rangle$ and is the variance conditional on *Q*. This term is related to the risk to a representative dealer from selling *Q/n* shares of the risky security. To execute a purchase order, a competitive broker conducts his search in a way that minimizes trading cost and search cost.

3.3 THE LARGE INVESTOR

In our model, the large investor comes to the market to trade for liquidity, portfolio hedging or other non-information reasons. To create a portfolio hedging motive for trade, we assume the liquidity trader is endowed with initial and unobservable holdings of h risky assets, where h is distributed normally with a normalized mean of zero and a variance of σ_h^2. In light of the strategies adopted by counter party dealers, the liquidity trader's order size *Q* must take into account the information obtained during the brokerage search process and its expected impact on the transaction price. In our model an information signal about the true value of the risky security can be obtained from the brokerage search process. To formalize this, we assume the liquidity trader, through the service of the broker, observes a private signal regarding the value of the risky asset[5] at the end of the search process but before the actual transaction. Let S_L denote the realization of this signal. S_L is drawn from a normal distribution with mean equal to the realized liquidation value *v* and variance $\frac{\sigma_v^2}{f}$, where *f* is related to the level of information in the market. For the sake of tractability and to focus on the effect of public disclosure, we assume *f* is only related to the accounting standard that governs the firm's financial disclosure. With more public information about the firm in the market, *f* is greater and the signal obtained from the search process is more accurate. The signal observed by the liquidity trader is drawn from a distribution of increasing precision. With an increasing flow of information, the signal to noise ratio increases with information flow. From the properties of the normal distribution [see for example, DeGroot (1970), p.167], the expected value of the security is a weighted average of the prior mean and the signal S_L,

$$E\left\langle \tilde{v} \middle| S_L \right\rangle = v_L = (1-\omega_0)0 + \omega_0 S_L \qquad (6)$$

where zero is the normalized prior mean and $\omega_0 = \frac{\sigma_v^2}{\sigma_v^2 + \frac{\sigma_v^2}{f}} = \frac{f}{f+1}$. The liquidity trader is also risk averse and has a utility function of the form given by equation (1). The post trade wealth of the investor is

$$\tilde{W}_L = \tilde{v}(Q+h) + Z_L - pQ - C \qquad (7)$$

where Z_L is the cash endowment of the liquidity trader and C the total search cost. Substituting equation (7) into equation (1), the liquidity trader's maximization problem is

$$\underset{Q}{Max}\, v_L = (Q+h) + Z_L - pQ - C - (\frac{\rho}{2})\sigma_L^2 (Q+h)^2 \qquad (8)$$

where σ_L^2 denotes the conditional variance of the asset's value and is equal to $\sigma_L^2 = \frac{\sigma_v^2 \sigma_v^2 / f}{\sigma_v^2 + \sigma_v^2 / f} = \frac{\sigma_v^2}{f+1}$ (DeGroot, 1970). We note the risk that the liquidity trader associates with buying Q decreases with the level of information flow. The optimal order size can be found by differentiating equation (8) with respect to *Q*, which yields,

$$v_L - Q\frac{\partial p}{\partial Q} - p - \frac{\partial C}{\partial Q} - \rho\sigma_L^2(Q+h) = 0 \qquad (9)$$

Counter party dealers observe *Q*, which reflects both an information-based motive resulting from search and a portfolio-hedging motive stemming from initial holdings for trade, but not *h* and S_L. Since dealers know the distribution of the value of the asset, the distribution of the private signal of the liquidity trader (but not the signal itself), and the investor's decision rule, i.e. equations (6) and (9), they can infer a noisy signal of the following form,

$$S_d = \frac{Q\frac{\partial p}{\partial Q} + p + \frac{\partial C}{\partial Q} + \rho\sigma_L^2 Q}{\omega_0} \qquad (10)$$

This is in fact a noisy signal of v_L and has the form $S_d = v_L + \eta h$, where $\eta = \frac{-\rho\sigma_L^2}{\omega_0}$ is a constant. Thus, for a dealer who cannot observe the liquidity trader's initial holdings of the risky security, h, S_d represents the unbiased estimate of the true value of the risky asset with variance of $\frac{\sigma_v^2}{f} + \eta^2\sigma_h^2$, given the order size Q. The trade price of the risky security is a weighted average of prior mean and the noisy signal S_d,

$$p_{post} = E\left\langle \tilde{v} \middle| Q \right\rangle = E\left\langle \tilde{v} \middle| S_d \right\rangle = (1-\omega_d)0 + \omega_d S_d \qquad (11)$$

where $\omega_d = \frac{\sigma_v^2}{\sigma_v^2 + \eta^2\sigma_h^2 + \sigma_v^2 / f}$ and zero is the normalized prior mean of the risky asset. Noted that $E\left\langle \tilde{v} \middle| Q \right\rangle$ in equation (11) first appeared in equation (3) and describes the process by which counter-party dealers arrive at the transaction price given the total trade size Q. From the properties of the normal distribution and the relations $\eta = \frac{-\rho\sigma_L^2}{\omega_0}$, $\omega_0 = \frac{\sigma_v^2}{\sigma_v^2 + \frac{\sigma_v^2}{f}} = \frac{f}{f+1}$, and $\sigma_L^2 = \frac{\sigma_v^2\sigma_v^2 / f}{\sigma_v^2 + \sigma_v^2 / f} = \frac{\sigma_v^2}{f+1}$,

we have

$$\phi = \rho Var\langle \nu \mid Q \rangle = \frac{\rho^2\sigma_v^2\sigma_h^2 + f}{\rho^2\sigma_v^2\sigma_h^2 + f^2 + f} \qquad (12)$$

which also appeared first in equation (3) and is related to the risk a representative dealer associates with supplying *Q/n* shares of the risky asset. From the expression of ω_d, we can see that the weight the counter-party dealer attaches to the noisy signal increases as *f*, the level of information flow in the market, increases. This is due to the fact that counter-party dealers realize the broker may be engaging in information gathering and that with public disclosure making more information available, it is more likely that the trade arranged by the broker is partly information motivated. However from equation (12), we observe that the risk a representative dealer associates with supplying *Q/n* shares of the risky asset decreases with an increasing information flow. Substituting equation (11) into equation (5), we have the following differential equation,

$$p = \omega_d S_d + \frac{\phi Q}{n} = A(Q\frac{\partial p}{\partial Q} + p + \frac{\partial C}{\partial Q} + \rho\sigma_L^2 Q) + \frac{\phi Q}{n}. \qquad (13)$$

where $A = \frac{\omega_d}{\omega_0} = \frac{f^2 + f}{f^2 + f + \rho^2\sigma_v^2\sigma_h^2}$ is the ratio of the weights the investor and a representative counter-party dealer attach to their respective signals and $\phi = \frac{\rho^2\sigma_v^2\sigma_h^2 + f}{\rho^2\sigma_v^2\sigma_h^2 + f^2 + f}$. The solution to equation (13) will yield the transaction price *p* for a large trade of size *Q* in a rational expectation equilibrium. We show in the next section that such an equilibrium exists if the information flow to the market is modest relative to the perceived motive for portfolio hedging.

4. EQUILIBRIUM

To determine the optimal number of counter party dealers, the broker conducts his search to minimize trading and search costs given the transaction price. His optimization problem is

$$\underset{n}{Min}\{Qp(Q,n) + \frac{\lambda n^2}{f}\} \qquad (14)$$

Differentiating equation (13) with respect to *n*, and setting it equal to zero, we have

$$\frac{\phi Q^2}{n^2} = \frac{2\lambda n}{f} \qquad (15)$$

The optimal number of dealers contacted can be expressed as a function of trade size Q,

$$n(Q) = (\frac{\phi f Q^2}{2\lambda})^{1/3} = 2^{(-1/3)}\alpha Q^{2/3} \qquad (16)$$

where $\alpha = (\frac{\phi}{\lambda} f)^{1/3}$ and is independent of *Q*. The total search cost is therefore

$$C = \lambda(\frac{\phi f Q^2}{2\lambda})^{2/3} = 2^{(-2/3)}\beta Q^{4/3} \qquad (17)$$

where $\beta = (\lambda^{1/2}\phi f)^{2/3}$ and is independent of *Q*. The marginal search cost per additional share is

$$\frac{\partial C}{\partial Q} = (\frac{4}{3})2^{(-2/3)}\beta Q^{1/3} = kQ^{1/3} \qquad (18)$$

where $k = (\frac{4}{3})2^{(-2/3)}\beta$ and is independent of *Q*. Substituting equation (16) and equation (18) into equation (13) and rearranging, we have

$$p = A[(k + \frac{l}{A})Q^{1/3} + Q\frac{\partial p}{\partial Q} + p + BQ] \qquad (19)$$

where $l = \frac{\phi}{2^{-1/3}\alpha}$ and $B = \rho\sigma_L^2 = \rho\frac{\sigma_v^2}{f+1}$ are both independent of Q. Solving equation (18) yields the equilibrium transaction price.

Proposition 1. There exists a rational expectation equilibrium in which the transaction price is given by

$$p = \frac{AB}{1-2A}Q + \frac{3A(k + l/A)}{3-4A}Q^{1/3}, \qquad (20)$$

if and only if $\frac{f(f+1)}{\sigma_v^2} < \rho\sigma_h^2$. That is, if firm-specific information is modest relative to the perceived need for portfolio hedging. The proof is shown in the appendix.

Proposition 1 indicates that with brokerage search, the price dependence on trade size, *Q*, is not linear. During the course of search, the broker will add more counter-party dealers if the reduction in price caused by reduced size exceeds the marginal cost. The brokerage search process mitigates the size impact on price by intensifying the search for counter-party dealers to take the other side of the trade as trade size increases. The requirement for the existence of equilibrium is a familiar requirement in trading models (see e. g. Glosten 1989) dealing with information signal to noise ratio. In our model, the broker and the liquidity trader update their prior distribution of the value of the risky asset according to new firm-specific information resulting from disclosure and search. In the limit as $f \to \infty$, the updated distribution will be normally distributed with mean v and zero variance in which case the investor will be buying as long as price is less than v without regard to any portfolio hedging motives. The market breaks down in our model if $\frac{f(f+1)}{\sigma_v^2}$, which could be interpreted as signal to noise ratio, exceeds the motive for portfolio hedging, $\rho\sigma_h^2$ and the liquidity trader *becomes* an informed trader during the search process and is perceived to trade for mostly informational motives. In order for a rational expectation equilibrium to exist, the signal obtained from search must be such that the signal to noise ratio, or the quality of firm-specific information has to be modest relative to the perceived need for non-information trading.

5. THE IMPACT OF PUBLIC DISCLOSURE AND EMPIRICAL IMPLICATIONS

We now examine the impact of information flow due to public disclosure. Combining equation (12) and equation (13), we have

$$p = \omega_d [\frac{1}{\omega_0}(Q\frac{\partial p}{\partial Q} + p + \frac{\partial C}{\partial Q} + \rho\sigma_L^2 Q)] + \frac{\rho^2\sigma_v^2\sigma_h^2 + f}{\rho^2\sigma_v^2\sigma_h^2 + f^2 + f}\frac{Q}{n}, \qquad (21)$$

or

$$p = \omega_d S_d + \frac{\phi^{2/3}Q^{1/3}}{f\lambda^{1/3}}. \qquad (22)$$

The first term represents counter-party dealers' information about the expected value of the risky asset and is a positive function of *f*. We note that S_d denote the noisy signal dealers infer from the total trade size *Q*. This is a noisy signal of v_L, the signal the investor obtains through brokerage search process, which is turn is a noisy signal of v, the true post trade value of the risky asset. Given a buy order of size Q, the realization of the signal would be higher than the prior expected value of the risky asset (which is normalized to zero). In equation (22), ω_d shows the weight counter-party dealers attach to the signal in their process of updating their information about their expected value of the risky asset. With public disclosure and, consequently, a higher level of information flow about the risky asset, the investor's signal becomes more accurate which in turn increases the accuracy of the noisy signal to the counter-party dealers. Being more confident, dealers attach more weight to their noisy signal in their updating process. Hence, public disclosure tends to increase the transaction price because information resulting from such disclosure improves their updating process. The second term in equation (22) represents the risk county party dealers associate with supplying the risky asset and is a negative function of *f*. With public disclosure and a greater information flow, the compensation a representative dealer demands for the risk of supplying *Q/n* shares of the risky asset decreases as long as the liquidity trader is perceived to be trading substantially for non-information motives, i.e. $\frac{f(f+1)}{\sigma_v^2} < \rho\sigma_h^2$. Based on the analysis of the endogenously determined price schedule of our model, we can decompose the impact of trade disclosure on the equilibrium transaction price into two components: information precision impact and risk impact. Precision impact refers to the impact of public disclosure on the precision of a counter-party dealer's signal. Disclosure tends to improve the precision of signals of all market participants, which results in higher transaction price. The risk impact refers to the risk a representative dealer associates with supplying *Q/n* shares of the risky asset. This risk decreases with disclosure and as a result dealers demand less compensation for bearing such risk, which results in lower price. In summary, our result suggests that public disclosure affects the equilibrium price in two ways: (1) Public disclosure increases the precision of all market participants' signals regarding the value of the risky asset and increases the equilibrium price; (2) Public disclosure reduces the adverse-selection risk counter-party traders associate with a trade of large size and reduces the equilibrium price. The net, overall effect of trade disclosure depends on the interaction of these two effects.

What is immediately obvious from equation (22) is the relationship between transaction prices and trade size. The first term is linear in *Q*, while the second term is nonlinear. As explained, the actual dependence of transaction prices on *Q* depends on which of the two opposing effects of disclosure dominates. A simple regression model such as

$$p = aQ + bQ^{\frac{1}{3}}$$

could be utilized to test the implication of equation (22). The economic and statistical significance of the two coefficients—*a* and *b*—should provide important insights to the relationship between *p* and *Q*. Furthermore, the regression analysis can be complemented by an event study before and after the enactment of the Sarbane-Oxley Act of 2002, which should shed light on the impact of disclosure on the *p-Q* relationship. We are in the process of actively pursuing transaction data of "upstairs market", which are not readily available. We intend to carry out the empirical analysis outlined here once relevant data become available.

6. CONCLUDING REMARKS

In this paper, we focus on the search process of a competitive broker in the service of a large investor and examine the impact of public disclosure on the process. We develop a rational expectation model where total trade size, the number of counter-party traders and price are determined endogenously. To execute a large trade, the investor searches for information regarding the value of a risky asset and contacts an optimal number of counter-party traders through the services of a broker. The precision of the investor's signal depends on the availability of specific information about the risky security in the market, which is connected to the public disclosure requirement. Our result suggests that disclosure influences the equilibrium price in two ways: (1) disclosure increases the precision of all market participants' signals regarding the value of the risky asset and increases the equilibrium price; (2) disclosure reduces the adverse-selection risk counter-party traders associate with a trade of large size and reduces the equilibrium price. The net, overall effect of disclosure depends on the interaction of these two effects. Further, we show that in order for rational expectation equilibrium to exist, the quality of firm-specific information resulting from disclosure has to be modest relative to the perceived need for non-information trading.

APPENDIX: PROOF OF PROPOSITION 1.

To show that $p = \frac{AB}{1-2A}Q + \frac{3A(k+l/A)}{3-4A}Q^{1/3}$ A(1)

is the solution to the differential equation

$$p = A[(k + \frac{l}{A})Q^{1/3} + Q\frac{\partial p}{\partial Q} + p + BQ], \qquad \text{A(2)}$$

we take derivative of equation A (1) with respect to Q, which yields

$$\frac{\partial p}{\partial Q} = \frac{AB}{1-2A} + \frac{A(k+l/A)}{3-4A} Q^{-2/3} \qquad \text{A(3)}$$

Multiplying equation A(3) by Q, we have

$$Q\frac{\partial p}{\partial Q} = \frac{AB}{1-2A}Q + \frac{A(k+l/A)}{3-4A} Q^{1/3} \qquad \text{A(4)}$$

We now substitute equations (A1) and (A4) into equation A(2), then
Both the RHS and LHS of equation A(2) are

$$A(\frac{AB}{1-2A}Q + \frac{3A(k+l/A)}{3-4A} Q^{1/3})$$

Further, the solution, equation A(1) satisfies the initial condition that

$$p(Q=0)=0$$

which implies that without trade, the expected price of the risky asset is same as the expected value of the prior distribution, which is a normal distribution with a normalized mean of zero and a variance of σ_v^2.

To show the condition for equilibrium, we note that, for a buy order, the coefficients of both term in equation A(1) must be positive, which implies $A < \frac{1}{2}$. This is a necessary and sufficient condition under which both coefficients will be positive. From the text,

$$A = \frac{\omega_d}{\omega_0} = \frac{f^2 + f}{f^2 + f + \rho^2 \sigma_v^2 \sigma_h^2}.$$

Simple algebraic manipulation yields

$$\frac{f(f+1)}{\sigma_v^2} < \rho \sigma_h^2.$$

Q.E.D.

ENDNOTES

1. The inadequacy of Enron's disclosures of its liabilities, risk exposure, and related party transactions is a good example.
2. A block trade is defined as a trade of 10,000 or more shares. Block trades represented over 50% of NYSE trading volume in 1993; the corresponding figure in 1965 is about 3%.
3. The mean of the distribution can assume any value. The value of zero is chosen, without loss of generality, for the sake of tractability.
4. We do not consider the case of dual capacity trading in which the broker may act as a broker-dealer and take position as one of the counter parties. We also abstract from the issue of agency problems between the investor and the broker in our analysis.
5. The broker in our model shares the signal obtained from the search process as part of her service

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FOOTBALL BETTING AND THE NEGLECTED-FIRM EFFECT REVISITED: A NOTE

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ABSTRACT

A study that tested the neglected-firm effect in the football-betting market for the 1985-1995 period was replicated for the 1996-2002 seasons. Wins-to-bets ratios were again compiled for the college teams rated *most-neglected* and *least-neglected*; however, schools so designated in the earlier investigation were re-evaluated and, where necessary, replaced to ensure that neglect—and not specific teams—functioned as the explanatory variable. Results suggest that neglected teams are not an exception to the efficient market hypothesis (EMH).

INTRODUCTION

When textbook writers discuss EMH anomalies, they unfailingly include the neglected-firm effect. It proposes that securities overlooked by analysts and investors are less likely to be correctly priced than those followed more closely and may therefore produce abnormal returns. Beyond its intuitive appeal, the neglected-firm effect enjoys empirical support from at least three separate studies. Arbel and Strebel (1983) found not only a small-firm effect among the Standard & Poor 500 stocks during the 1972-1976 period but a neglected-firm effect as well when stocks with limited information and institutional support outperformed their more publicized and popular counterparts across all size categories. Barry and Brown (1984) also reported that lower-profile stocks generated higher returns in the absence of a size effect. Finally, James and Edmister (1983) concluded that while neglect (in the trading activity sense) and firm size are highly correlated, they impact stock returns in distinct ways. In sum, while neglect and size are not the same phenomenon, it seems doubtful that the former will ever escape the shadow of the latter in the eyes of stock market observers.

But what about the football-betting market? Can neglect and size be differentiated more clearly when betting outcomes replace stock returns as a measure of pricing efficiency? Pankoff (1968) reasoned that the market for football wagers is a handy proxy for the securities market since bettors are no less numerous, knowledgeable or competitive than investors and that gambling profits represent a bona fide exception to the efficient market hypothesis. The betting-investing analogy seems especially useful for partitioning neglect and size. In football, *size* is controlled for by equal numbers of players in

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the professional game and by equal numbers of scholarships in college. To the extent that *neglect* can be reasonably operationalized, any impact it may exert on wins-to-bets (W/B) ratios would not be confounded by a size effect. Kochman and Waples (1998) defined neglect as the sum of scant national press, a small fan base and limited on-field success and hypothesized that college football teams satisfying that definition are less likely to be correctly handicapped by Las Vegas oddsmakers and may therefore provide opportunities for regular profits. Kochman and Waples rated 20 colleges as most-neglected and an additional 20 schools as least-neglected for the 1985-1995 years. Contrary to expectations, the latter group achieved a higher W/B ratio (52.3 percent) than the neglected teams (48.4 percent).

METHODOLOGY

This paper replicates the Kochman and Waples study by extending the hypothesis that neglected teams are mispriced to the 1996-2002 period. Like K&W, we judged (in)efficiency on the basis of wins-to-bets ratios, which were tested for randomness and profitability per Equations (1) and (2), respectively. While the former model predictably uses a required rate of 50 percent, the latter employs a hurdle rate of 52.4 percent to reflect the customary 10-percent cost of placing a wager and the resulting need to win 11 of 21 bets to break even. The source of betting outcomes was Steele (2003) while Gandar et al. (2001) contributed the statistical tests. Where this current study departs from its predecessor is in the number and composition of most- and least-neglected teams. For the 1996-2002 measurement period, we identified 15 schools which met our condition of neglect—namely, shortages of media coverage, fan support and on-field success—and 15 institutions which represented the opposite. Better ways to define *neglect* never proved practical.

$$Z_R = \frac{(W/B - 0.5)}{\{[(0.5)(1 - 0.5)]/B\}^{1/2}} \tag{1}$$

$$Z_\Pi = \frac{(W/B - 0.524)}{\{[(0.524)(1 - 0.524)]/B\}^{1/2}} \tag{2}$$

where: Z_R = statistic for testing the null hypothesis of randomness

Z_Π = statistic for testing the breakeven hypothesis

W = number of winning wagers

B = number of total wagers

The decision to shorten the list of most- and least-neglected teams from 20 in the original study to 15 in this investigation stemmed, in part, from the belief that fewer schools would mean fewer questionable characterizations. Where colleges regularly handicapped are arrayed along a continuum ranging from famous to obscure, we chose the 15 schools which, we believed, clustered at each end—leaving roughly 100 teams to occupy the middle. Another motivation to shrink our sample size was the sense that the greater availability of information (e.g., via the Internet and newsstand publications) during the 1996-2002 span (vis-à-vis 1985-1995) meant that the incidence and degree of neglect would necessarily be diminished. A re-evaluation of schools in the prior study led to only one change among the current subject teams—Southern Methodist University replaced Rice.

RESULTS

When we placed (imaginary) bets on our 15 most- and least-neglected teams during the 1996-2002 seasons, we generated wins-to-bets ratios of 47.8 percent and 50.1 percent, respectively. Since the former group tended to be underdogs, wins were achieved one of two ways: by winning the game outright or by losing by a margin that was smaller than the point spread. Inasmuch as the least-neglected schools were generally favorites, wins were notched by beating their opponents by a margin that was greater than the spread. For the most-neglected teams, the 47.8-percent W/B ratio was not significantly different from the 0.5 proportion expected under the randomness null hypothesis (Z_R = -1.49 with p = 0.136) but was significantly below the 0.524-percent breakeven rate (Z_Π = -3.11 with p < 0.001). For the least-neglected schools, the

Table 1

Wins-to-bets ratios for 15 most-neglected college football teams (1996-2002)

College	**Wins**	**Bets**	**W/B**
Army	34	72	47.2%
Fresno State	38	78	48.7%
Hawaii	38	78	48.7%
Memphis	36	75	48.0%
Navy	40	74	54.1%
New Mexico	43	76	56.6%
Rutgers	31	74	41.9%
San Diego State	37	76	48.7%
Southern Methodist	34	78	43.6%
Temple	34	75	45.3%
Texas El Paso	37	77	48.1%
Tulane	40	74	54.1%
Tulsa	26	75	34.7%
Utah	40	77	51.9%
Wyoming	35	76	46.1%
Totals	**543**	**1135**	**47.8%**
Z_R	**-1.49**		
Z_Π	**-3.11**		

W/B ratio of 50.1 percent was neither significantly different from the 0.5 proportion (Z_R = 0.69 with p = 0.490) nor significantly below the 0.524 mark (Z_Π = -1.59 with p = 0.112).

Table 2

Wins-to-bets ratios for 15 least-neglected college football teams (1996-2002)

College	Wins	Bets	W/B
Alabama	40	79	50.6%
Auburn	37	77	48.1%
Florida	40	77	51.9%
Florida State	43	80	53.8%
Miami, FL	41	76	53.9%
Michigan	35	78	44.9%
Nebraska	39	82	47.6%
Notre Dame	40	79	50.6%
Ohio State	42	81	51.9%
Oklahoma	41	79	51.9%
Penn State	42	81	51.9%
Southern California	40	82	48.8%
Tennessee	40	80	50.0%
Texas	39	81	48.1%
UCLA	36	75	48.0%
Totals	**595**	**1187**	**50.1%**
Z_R	**0.69**		
Z_Π	**-1.59**		

CONCLUSIONS

It seems fair to conclude that neglect is no threat to the efficient market concept. Neglected college teams beat their respective point spreads at a rate (47.8 percent) that was both significantly below the breakeven mark and nearly identical to the disappointing 48.4-percent W/B ratio reported in the earlier neglected-firm effect study. From the 50.1-percent ratio produced by our least-neglected schools, we can infer that public teams do not appear to be burdened (and overpriced) by the inflated point spreads, which might have been anticipated from their high visibility.

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IMPLICATIONS OF AGGREGATE DEMAND ELASTICITY FOR THE PHILLIPS CURVE

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I. INTRODUCTION

Since its introduction in 1958, the Phillips curve has assumed an important position in macroeconomics.[1] The modern analytical approach to the Phillips curve in principles and intermediate level texts relies on the familiar aggregate demand, aggregate supply model to distinguish between demand-pull and cost-push inflation and, within this framework, the role of aggregate supply for the Phillips curve is relatively well established. For example, Mankiw states, "the Phillips curve is a reflection of the short-run aggregate supply curve."[2] Gordon's approach provides a lucid explanation of the strong relationship between both the slopes and shifts of the short-run aggregate supply curve and the short-run Phillips curve.[3]

While the general relationship between the aggregate supply curve and the Phillips curve is recognized, the importance of aggregate demand and, in particular, aggregate demand elasticity, for the inflation-unemployment relationship has been untreated. We believe, however, that the elasticity of aggregate demand with respect to the general price level does have some significance for the short-run Phillips curve since, on a general level, the economy's equilibrium price level, inflation rate, real gross domestic product, and unemployment rate are determined jointly by aggregate supply and aggregate demand. The primary purpose of this paper then is to demonstrate with a graphical analysis the implications of aggregate demand elasticity for the Phillips curve.

The paper proceeds as follows. Section II develops a model of aggregate demand and discusses some relationships between aggregate demand elasticity and the macroeconomy. Section III presents the analysis between the elasticity of aggregate demand and the Phillips curve. Section IV concludes by providing a short summary of our results.

II. A MODEL OF AGGREGATE DEMAND

The elasticity of aggregate demand with respect to the price level is a concept which has been largely ignored in the macroeconomic literature, both theoretically and empirically. From a theoretical

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The authors are The Benjamin Wall Ingram, III, Professor of Economics, Francis Marion University, Florence, SC, and Professor of Economics, St. John Fisher College, Rochester, NY, respectively. We thank an anonymous referee and the editor for helpful suggestions on an earlier version of this paper. Any errors which remain are our own.

perspective, and from its foundation in the quantity theory of money, the Classical school implied that aggregate demand was unit elastic with respect to the price level.[4] Alternatively, Keynes[5] and his early followers believed that aggregate demand had a variable elasticity and, in the special case of a liquidity trap, could be perfectly price level inelastic. In earlier papers, we have shown the relevance of aggregate demand elasticity for supply-side economics[6,7] and monetary policy rules[8].

Relatively few empirical studies of aggregate demand elasticity are available and perhaps the earliest are found in Green[9]. We have previously estimated this elasticity for the United States[10] and Canada[11], and Apergis and Elestherio have calculated this elasticity for Greece[12]. Because this concept is generally neglected, this section develops a model of aggregate demand and derives expressions for both the slope of the economy's aggregate demand curve and the price level elasticity of aggregate demand.

For simplicity, we assume a private economy with no government. In the product market, real private saving (s) is assumed to depend on real income (Q) and real money balances (M/P), while real investment (i) is determined by the market rate of interest (r). The general price level (P) is defined by the GDP deflator. Total real imports (m) are defined as a function of both real income and the domestic price level while total real exports (x) are stated as a function of only the domestic price level. The product market equilibrium condition may then be stated as:

$$s(Q, M/P) + m(Q,P) = i(r) + x(P) \qquad (1)$$

In the money market, the demand for real balances is a function of both real income and the interest rate. The nominal money supply (M) is assumed to be exogenous. Equilibrium in the money market is then given as:

$$M/P = l(Q,r) \qquad (2)$$

The derivation of the expression for the economy's aggregate demand function begins by differentiating equations (1) and (2) to obtain:

$$s_Q dQ + s_{M/P}(PdM - MdP^2) + m_Q dQ + m_P dP = i_r dr + x_P dP \qquad (3)$$

and

$$PdM - MdP/P^2 = l_Q dQ + l_r dr \qquad (4)$$

where, from standard macroeconomic theory s_Q, l_Q, and $m_P > 0$ and $s_{M/P}$, i_r, x_P and $l_r < 0$. By assuming that the nominal money supply is constant, solving the product market equation (3) for dr and substituting that expression into (4) and rearranging, the slope of the economy's aggregate demand curve may be expressed as:

$$\frac{dQ}{dP} = \frac{1}{P}\left(\frac{-M/P}{l_r(\frac{\partial r}{\partial Q_{IS}} - \frac{\partial r}{\partial Q_{LM}})} + \frac{S_{M/P}M/P}{i_r(\frac{\partial r}{\partial Q_{IS}} - \frac{\partial r}{\partial Q_{LM}})} + \frac{(x_P - m_P)}{i_r(\frac{\partial r}{\partial Q_{IS}} - \frac{\partial r}{\partial Q_{LM}})} \right) \qquad (5)$$

Equation (5), which can be shown to be unambiguously negative, demonstrates that the total effect of a change in the general price level is the summation of three effects: the Keynes or interest rate effect, the Pigou or real balance effect, and the Mundell-Fleming or international effect. Equation (5) may then be restated in elasticity form as:

$$\xi_{Q,P} = \frac{1}{PQ}\left(\frac{-M}{l_r(\frac{\partial r}{\partial Q_{IS}} - \frac{\partial r}{\partial Q_{LM}})} + \frac{S_{M/P}M}{i_r(\frac{\partial r}{\partial Q_{IS}} - \frac{\partial r}{\partial Q_{LM}})} + \frac{(x_P - m_P)P^2}{i_r(\frac{\partial r}{\partial Q_{IS}} - \frac{\partial r}{\partial Q_{LM}})} \right) \qquad (6)$$

$$\frac{\delta r}{\delta Q_{IS}} = \frac{s_Q + m_Q}{i_r} < 0, \qquad (6a), \qquad \frac{\delta r}{\delta Q_{LM}} = -\frac{l_Q}{l_r} > 0. \qquad (6b)$$

Equation (6) is useful to investigate the relationship between aggregate demand elasticity and important structural parameters in the macroeconomy, while equations (6a) and (6b) make explicit the underlying parameters contained in the IS-LM core of this model. For example, it is clear from equation (6) that aggregate demand is less elastic with respect to the price level the more responsive is the demand for money to changes in the interest rate. In the extreme case of a liquidity trap when l_r approaches infinity, the first term on the right side of equation (6) reduces to zero and aggregate demand elasticity is accordingly decreased.

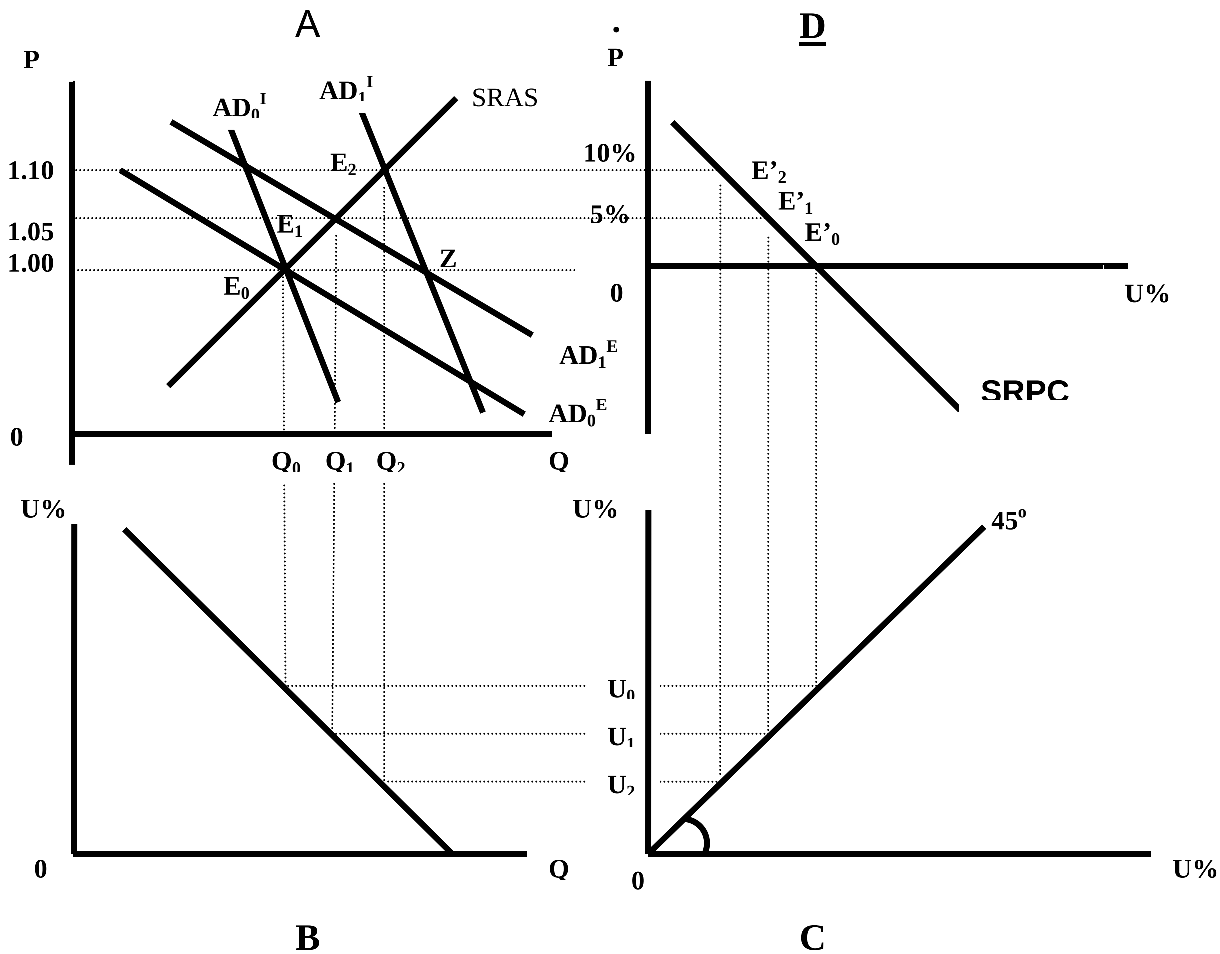
It is also rather evident from equation (6) that aggregate demand elasticity is reduced as the responsiveness of investment spending to changes in the interest rate decreases. In the special case when $i_r = 0$, the first term on the right side of equation (6) again reduces to zero and decreases the elasticity of aggregate demand.

III. AGGREGATE DEMAND ELASTICITY AND THE PHILLIPS CURVE

A. Demand-Pull Inflation

Our analysis of the relationship between aggregate demand elasticity and the Phillips curve is conducted with the four-quadrant diagram system shown in Figure 1.

Figure 1



Panel A is the aggregate demand, aggregate supply model with the customary positively-sloped short-run aggregate supply curve SRAS. Two distinct aggregate demand curves are drawn to pass through common point E_0. Thus, the flatter of the two linear schedules is more elastic with respect to the general price level and is labeled accordingly as AD_0^E while the steeper or relatively more inelastic aggregate demand curve is labeled AD_0^I. Regardless of aggregate demand elasticity, macroeconomic equilibrium occurs at point E_0, with the price level P_0, for convenience equaling 1.00, and the level of real gross domestic product Q_0.

Panel B demonstrates the general principle of Okun's law, or specifically the inverse relationship between the unemployment rate (U%) and the level of real gross domestic product. Given the exact nature of the relationship depicted by the negatively sloped function in this quadrant, the value of Q in panel A determines the unemployment rate ($U\%_0$) in panel B.

Panel C serves only as a reflection locus, i.e., the 45^0 line transfers the predetermined unemployment rate from the vertical axis to the horizontal. This value is then projected upward to panel D, where the Phillips curve is constructed to later demonstrate the impact of a change in the elasticity of aggregate demand. Hence, reading counterclockwise through the system from point E_0 in panel A to panel D, we arrive at point E_0', the initial point on the short-run Phillips curve SRPC.[13]

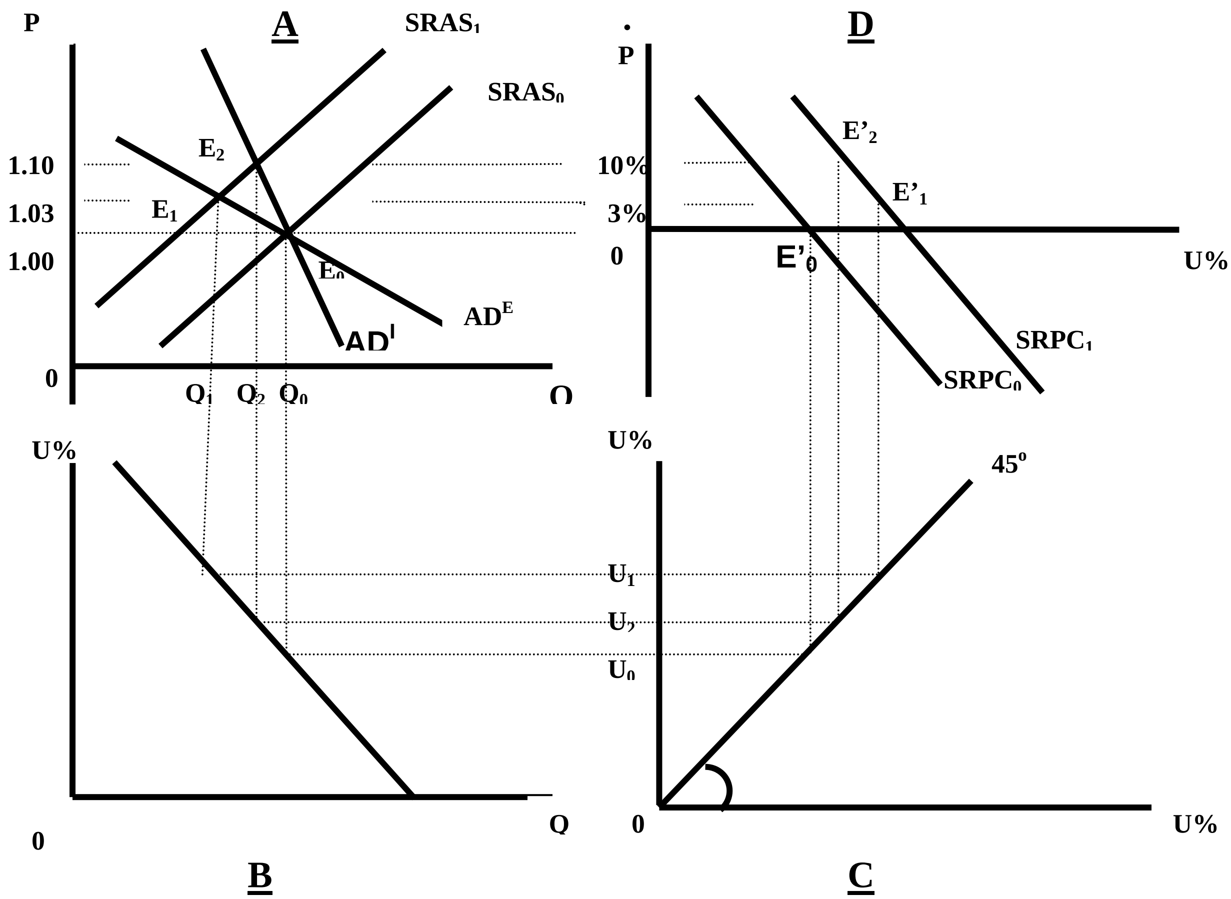
Now suppose that an external factor leads to an increase in aggregate demand. More specifically, assume that this increase is applied to both aggregate demand curves in panel A causing a rightward shift of equal amounts, shown by E_0Z. As long as aggregate supply is positively sloped, the general and unambiguous outcome of the increase in aggregate demand is a higher price level and inflation, higher real gross domestic product and a lower unemployment rate that yields the familiar downward sloping Phillips curve. It is apparent, however, that the amount of inflation, the decrease in unemployment, and the corresponding movement along the given short-run Phillips curve is determined by the elasticity of aggregate demand with respect to the price level. That is, if aggregate demand is elastic, the economy moves to point E_1 in panel A, where the price index has risen to, say 1.05, and real GDP has increased to Q_1. Tracing counterclockwise through the four quadrants, we generate point E_1' on the SRPC, with an inflation rate of five percent and a lower unemployment rate $U\%_1$. If aggregate demand is less elastic, the same rightward shift of aggregate demand results in macroeconomic equilibrium at E_2 in panel A and point E_2' on the Phillips curve in panel D. The inflation rate and real GDP are greater, ten percent and Q_2, respectively, and the unemployment rate is lower, $U\%_2$. The conclusion is straightforward: for identical increases in aggregate demand, the leftward movement along a given short-run Phillips curve is greater (less) the less (more) elastic is aggregate demand with respect to the price level.[14] It follows that equal shifts in aggregate demand and the resulting movement along a given short-run Phillips curve have a correspondence to but are not deterministic with respect to changes along a stationary short-run aggregate supply curve.[15]

B. Cost-Push Inflation

Figure 2 demonstrates the relevance of aggregate demand elasticity for the short-run Phillips curve when a decrease of aggregate supply occurs. As before, two linear aggregate demand curves with different elasticities are constructed to intersect the original aggregate supply $SRAS_0$ at point E_0, which gives point E_0' on the original short-run Phillips curve, $SRPC_0$. Then, if aggregate supply decreases to $SRAS_1$, as long as aggregate demand is negatively sloped there will unambiguously be higher inflation and unemployment rates and a corresponding rightward shift of the short-run Phillips curve. In this case, although the amount of the rightward shift of the Phillips curve depends only on the leftward shift of aggregate supply[16], the increase of inflation and unemployment and therefore the path or movement from one Phillips curve to the other is determined by the price level elasticity of aggregate demand.

If aggregate demand is elastic, the decrease of aggregate supply in panel A moves the economy to point E_1 with the price level rising to the assumed value of 1.03, and real GDP decreasing to Q_1. Then, tracing counterclockwise through the system, we arrive at the corresponding point E_1' on the new Phillips curve, $SRPC_1$ in panel D. If aggregate demand is more inelastic with respect to the price level, however, the same decrease of aggregate supply moves the economy to points E_2 and E_2', with a larger increase in inflation and a smaller decrease in output. The conclusion is again straightforward: for decreases of aggregate supply, the vertical (horizontal) movement from one short-run Phillips curve to another is greater the less (more) elastic is aggregate demand with respect to the price level.[17]

Figure 2



IV. CONCLUSION

The relationship between aggregate supply and the Phillips curve is well known. A concept forgotten within macroeconomics in general and in analyses of the short-run Phillips curve in particular is the price level elasticity of aggregate demand. We have found that aggregate demand elasticity influences the inflation-unemployment tradeoff in scenarios involving both demand-pull and cost-push inflation. More specifically, we obtain two results. First, for equal horizontal shifts of aggregate demand, the increase in inflation and decrease in unemployment are greater the less elastic is aggregate demand with respect to the general price level. Stated alternatively, the lower the price level elasticity of aggregate demand, the greater is the leftward movement along a given short-run Phillips curve for demand-pull inflation. Second, for experiences with cost-push inflation, the upward or counterclockwise movement from one SRPC to another is greater the less elastic is aggregate demand with respect to the price level. Alternatively, with cost-push inflation, the increase in inflation is greater and the increase in unemployment is smaller the lower the price level elasticity of aggregate demand.

While the conclusions obtained in this paper are theoretical in nature, the actual relevance of aggregate demand elasticity for the economy and, specifically, the Phillips curve is an empirical issue. In this vein, our earlier research[18] indicates that aggregate demand does indeed demonstrate a variable elasticity over time, as this paper has assumed, and that for most of the examined time period of 1955 to 1991 aggregate demand was price level elastic in the United States. More specifically, our estimated aggregate demand elasticity coefficient exceeded unity for eighty percent of the total one hundred forty eight quarters of time series data. This historical responsiveness of aggregate demand to changes in the price level implies that demand shocks, such as in Figure 1 would, ceteris paribus, most often result in relatively small movements along a given Phillips curve. Additionally, an elastic aggregate demand function suggests that cost-push inflation, as in Figure 2, should manifest as a relatively more horizontal rather than vertical movement from one Phillips curve to another, ceteris paribus.

ENDNOTES

1. Phillips (1958)
2. See Mankiw (2003), page 359.
3. See Gordon (2003), pages 227-230.
4. For more detail see Gambs (1974).
5. Keynes (1936).
6. Kyer and Maggs (1994)
7. Kyer and Maggs (1996)
8. Kyer and Maggs (1995)
9. Green et. al., (1991).
10. Kyer and Maggs (1997).
11. Kyer and Maggs (1999)
12. Apergis and Elestherio (2000)
13. Panel D is constructed in Figures 1 and 2 such that, together with the initial price level of 1.00, the absolute changes of the price level in panel A translate neatly to the inflation rate plotted vertically in panel D.
14. Alternatively, the aggregate demand curves having differing elasticities may be viewed as shifting up vertically by the same amount. In this case, the conclusions are reversed, i.e., the inflation rate is higher, the decrease in unemployment is larger, and the resulting leftward movement along a given short-run Phillips curve is greater the higher is the price-level elasticity of aggregate demand.

15. Although a given shift in the aggregate demand curve has a systematic effect on the resulting movement along the Phillips curve, the magnitude of this relationship will be variant because of the stochastic nature of the Okun relationship.

16. This conclusion is easily demonstrated with our graphical framework.

17. If aggregate demand were perfectly inelastic, the decreased aggregate supply would cause only inflation, i.e., no increase in unemployment. The economy would therefore move upward from one short-run Phillips Curve to another. Conversely, if aggregate demand were perfectly elastic, a negative supply shock would leave the price level unaffected and only raise unemployment, moving the economy horizontally from one SRPC to another.

18. For more detail, see Kyer and Maggs (1997).

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REFEREES

1. Monica Cherry
2. Joseph Eisenhauer
3. Jason Hecht
4. Elia Kacapyr
5. Thomas Kopp
6. William O’Dea
7. Philip Pfaf
8. David Ring
9. Donald Vitaliano

New York State Economics Association
Annual Meetings, October 9-10, 2003
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CONFERENCE PROGRAM

Thursday, October 9

5:30 – 7:30 PM
Wine and Cheese Reception
Federal Reserve Bank of New York

Friday, October 10

<u>Schedule</u>

8:30 – 9:00	Continental Breakfast & Registration
9:00 – 10:30	Concurrent Sessions: Group I
10:30 – 10:45	Morning Break
10:45 – 12:15	Concurrent Sessions: Group II
12:30 – 1:30	Lunch: Speaker – Edmund Phelps, Columbia University
1:45 – 3:15	Concurrent Sessions: Group III
3:15 – 3:30	Afternoon Break
3:30 – 4:30	Concurrent Sessions: Group IV
4:30 – 5:30	Business Meeting of the Board of Directors (open to all members)

(Session codes A,B,C, D correspond to room assignments)

9:00 – 10:30 a.m.
Concurrent Sessions: Group I

(I-A) Labor Economics
Chair: Johathan Schwabish, NYC Partnership

Delia Furtado (Brown University)
"West Side Story and Human Capital: An Imperfect Information Explanation of Ethnic Endogamy"
Discussant: Dale Tussing, Syracuse University

Ryuichi Tanaka (New York University)
"School Choice and Income Inequality"
Discussant: Jonathan Schwabish, NYC Partnership

Craig Rogers (Canisius College)
"Black Professional Employment: Over-representation in Large Firms and Under-representation in Small Firms"
Discussant: Erica Groshen, Federal Reserve Bank of New York

Jonathan Schwabish (NYC Partnership)
"Income Differences Across Time and Measure"
Discussant: Rae Rosen, Federal Reserve Bank of New York

(I-B) Finance I
Chair: Barbara Howard, SUNY Geneseo

David Jestaz (Drew University)
"Tobin's q, Internal Funds and Risk Premium on the Capital Market: A Tale of Two Worlds"
Discussant: James Mahoney, Federal Reserve Bank of New York

Alireza Dorestani (Albany State University)
"How Persistent is the Canadian Equity Funds' Performance? Some Empirical Evidence from Contingency Table Analysis"
Discussant: Barbara Howard, SUNY Geneseo

Sadayuki Ono (University of Virginia)
"Option Pricing Under Stochastic Volatility and Trading Volume"
Discussant: Tony Rodrigues, Federal Reserve Bank of New York

I-C) Manufacturing
Chair: James Orr, Federal Reserve Bank of New York

Charles Steindel (Federal Reserve Bank of New York)
"Manufacturing and the Business Cycle"
Discussant: David Ring, SUNY Oneonta

Jim Orr and Richard Deitz (Federal Reserve Bank of New York)
"Manufacturing Restructuring in the 1990s"
Discussant: Ron Kalafsky, Daemen College

Ron Kalafsky (Daemen College)
"The Post 1990 Rebirth of the U.S. Machine Tool Industry: A Temporary Recovery"
Discussant: Jim Orr, Federal Reserve Bank of New York

(I-D) International Economics I
Chair: Christopher Graham, Bank of Canada

Aziz Karimov (Northeastern University)
"A Single Currency for the Central Asian Region"
Discussant: Cedric Tille, Federal Reserve Bank of New York

Sunghee Choi (Claremont College)
"Exchange Rate Exposure of U.S. Multinationals: Evidence from the Asian Crisis"
Discussant: TBA

H. Mikael Sanberg (University of Florida)
"The Impact of History and Regionalism on CARICOM Bilateral Trade: A Preliminary Analysis Using the Gravity Model"
Discussant: Christopher Graham, Bank of Canada

Kiril Tochkov (Binghamton University)
"Intranational Risk Sharing in Transition Economics: Evidence from China"
Discussant: TBA

10:45 – 12:15 p.m.
Concurrent Sessions: Group II

(II-A) Economic Thought
Chair: Florence Shu, SUNY Potsdam

Behrouz Tabrizi, (St. Francis College)
"Islamisation of the Economic System: Islamic Man Versus Economic Man"
Discussant: Kent Klitgaard, Wells College

Dr. William Ganley (Buffalo State College)
"Veblen and Fisher on Capital Finance"
Discussant: Florence Shu, SUNY Potsdam

(II-B) Finance II
Chair: Izabella Lokshina, SUNY Oneonta

Fan Huang (SUNY Albany)
"Asymmetric Response of Volatility to Market Return Shocks"
Discussant: David Jestaz, Sarah Laurence College

Nuno Sousa (Banco Espirito Santo, NY)
"Option Pricing Theory and the Recognition of Credit Risk Deterioration in Credit Default Swaps Markets--An Empirical Evaluation of Competing Models"
Discussant: Joshua Rosenberg, Federal Reserve Bank of New York

JaBonn Kim (SUNY Albany)
"Behavioral Equilibrium and Risk Premia"
Discussant: Sunghee Choi, Claremont College

Dr. Izabella Lokshina (SUNY Oneonta)
"Expert System, Supporting Investment Decisions Under Fuzzy Information Background of Stock Operations"
Discussant: Alirenza Dorestani, Albany State University

<u>(II-C) Applied Microeconomics</u>
Chair: William O'Dea, SUNY Oneonta

Joana Quina (University of Warwick)
“The Supply of Bribes: How Much do Firms Pay?”
Discussant: William O'Dea, SUNY Oneonta

Richard Vogel (Farmingdale State University of NY)
“Estimating the Impact of Computer Viruses”
Discussant: Joana Quina, University of Warwick

Kent Klitgaard (Wells College)
“Substitution and Sustainability: Towards a Microfoundation of Ecological Economics”
Discussant: Joseph Eisenhauer, Canisius College

<u>(II-D) Macroeconomics and Central Banking</u>
Chair: Virginie Traclet, Bank of Canada

Mehtap Kesriyeli (University of Manchester)
“Asymmetric Interest Rate Rules: Evidence from the US, the UK and Germany”
Discussant: Virginie Traclet, Bank of Canada

Virginie Traclet (Bank of Canada)
“How to Promote Successful Central Banking. Some Indicators of an "Efficient Monetary Environment"”
Discussant: Meg McConnell, Federal Reserve Bank of New York

Patrick Musso (LATAPSES-IDEFI)
“Productivity Slowdown and Resurgence: The Role Capital Obsolescence”
Discussant: Richard Skolnik, SUNY Oswego

Alain Nubrel (University of LaReunion
“Are Imports Conducive to Inward Foreign Direct Investment? Looking for a Globalisation Memory Effect”
Discussant: Jonathan McCarthy, Federal Reserve Bank of New York

1:45 – 3:15 p.m.
Concurrent Sessions: Group III

<u>(III-A) Issues in the New York Economy</u>
Chair: Erica Groshen, Federal Reserve Bank of New York

Jason Bram (Federal Reserve Bank of New York)
"Commuting Patterns in the New York Metropolitan Region"
Discussant: William O'Dea, SUNY Oneonta

Mohammad Arzaghi (Brown University)
“Knowledge Spillovers vs. Knowledge Sharing: Advertising Agencies in Manhattan”
Discussant: Jason Bram, Federal Reserve Bank of New York

Erica Groshen (Federal Reserve Bank of New York)
“The Jobless Recovery and Economic Restructuring in New York State”
Discussant: Richard Vogel, SUNY Farmingdale

<u>(III-B) Macroeconomics II</u>
Chair: David Ring, SUNY Oneonta

Richard Skolnik (SUNY Oswego)
"The Effect of Inflation on Long-term Changes in U.S. Asset Intensity"
Discussant: Scott Trees, Siera College

Christopher Graham (Bank of Canada)
"Financial Conditions Indices for Canada"
Discussant: Charles Steindel, Federal Reserve Bank of New York

David Ring (SUNY Oneonta)
"The Effect of Changes in Relative Prices on the Rate of Inflation"
Discussant: Robert Rich, Federal Reserve Bank of New York

<u>(III-C) Econometrics and Measurement Issues</u>
Chair: Elia Kacapyr, Ithaca College

Dr. Robert Culp (Penn State University, Lehigh Valley)
"A Mathematical Approach to Demand Estimation in Multi-Segment Oligopoly Markets--with an Application to the Automobile Market"
Discussant: Elia Kacapyr, Ithaca College

Joseph Eisenhauer (Canisius College)
"A Test of Hotelling's Valuation Principle for Nonrenwable Resources"
Discussant: Wouter Vergote, Columbia University

Saeid Kashani (Universite De Reenes)
"A Fuzzy Logic Paradigm for Industrial Economics Analysis"
Discussant: Dr. Robert Culp, Penn State University

JaBonn Kim (SUNY Albany)
"N-Asymptotic Dynamic Panel Model with Short Panel"
Discussant: Elia Kacapyr, Ithaca College

<u>(III-D) Families and Classroom Economics</u>
Chair: Dale Tussing, Syracuse University

Irina Paley (Brown University)
"Time Allocation to Children in American Families"
Discussant: Dale Tussing, Syracuse University

Alireza Dorestani (Albany State University)
"Is Interactive/Active Learning Superior to Traditional Lecturing in Economics Courses?"
Discussant: Alfred Lubell, SUNY Oneonta

Dale Tussing (Syracuse University)
"Practice Style and Peer Influence: Method of Obstetric Delivery and Indications for Cesarean Section"
Discussant: Frank Musgrave, Ithaca College

Wouter Vergote (Columbia University)
"Optimal Unemployment Insurance with Monitoring and Sanctions: Should Benefits Decrease with the Unemployment Spell?"
Discussant: Joseph Tracy, Federal Reserve Bank of New York

3:30 – 4:30 p.m.
Concurrent Sessions: Group IV

(IV-A) Public and Agricultural Economics
Chair: Andrew Haughwout, Federal Reserve Bank of New York

Scott Trees (Siera College)
"Land Trusts and the Sustainability of Community Supported Agriculture"
Discussant: Behrouz Tabrizi, St. Francis College

Pellegrino Manfra (CUNY)
"The Effect of Local Taxes on Direct Investment, Economic Growth and Development: The Case of Puerto Rico"
Discussant: Andrew Haughwout, Federal Reserve Bank of New York

(IV-B) Chemical Industry Economics
Chair: Arthur Gow, University of New Haven

Arthur Gow (University of New Haven)
"A Neoclassical Theory of Commodity Chemical Production"
Discussant: Demetri Petrides, Intelligen, Inc.

Demetri Petrides (Intelligen, Inc.)
"Manufacturing of Active Pharmaceutical Compounds - How Much Does it Cost to Make a Kilo of a Product?"
Discussant: Arthur Gow (University of New Haven)

(IV-C) Environmental Economics
Chair: Alfred Lubell, SUNY Oneonta

Thomas Sadler (Manhattan College Parkway)
"Contemporary Environmental Policy: Toward a Comprehensive Commitment to Quality"
Discussant: Alfred Lubell, SUNY Oneonta

(IV-D) International Economics II
Chair: Florence Shu, SUNY Potsdam

M. Ansari (Albany State University)
"Study of the Impact of Foreign Capital on Domestic Economy of South Africa"
Discussant: Pellegrino Manfra, CUNY

Bulent Unel (Brown University)
"Technology Diffusion Through Trade in a Panel of OECD Industries"
Discussant: Florence Shu, SUNY Potsdam